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SERIE: **FISKERI** · BIND IV

NR. 6. BJARNI SÆMUNDSSON: CONTINUED MARKING EXPERIMENTS ON PLAICE AND COD IN ICELANDIC WATERS.

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
TRYKT HOS J. JØRGENSEN & CO. (IVAR JANTZEN)
1913

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MEDDELELSER FRA KOMMISSIONEN FOR HAVUNDERSØGELSER
SERIE: FISKERI · BIND IV · NR. 6 · 1913

CONTINUED MARKING EXPERIMENTS

ON

PLAICE AND COD IN ICELANDIC WATERS

BY

BJARNI SÆMUNDSSON

(WITH 7 FIGURES IN THE TEXT)

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
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Introductory Remarks

In the years 1903, 1904 and 1905 experiments in marking plaice and cod were carried out on the north and east coast of Iceland on board the Danish research steamer »Thor« under the supervision of Dr. Johs. Schmidt, the wellknown leader of the International Fisheries Investigation in the waters round Iceland and the Faroes. An account of these experiments was given by Dr. Schmidt in Vol. II, No. 6 of this Series[1]), in the year 1907, under the title: Marking Experiments on Plaice and Cod in Icelandic Waters. According to this account ca. 4 % of the marked plaice and 4,6 % of the marked cod were recaptured, i. e. so many marks of recaptured fish received by the author at the time when the paper was published; and although relatively few of the marked fish were retaken, a considerable number of very interesting facts were stated concerning the migrations, growth and capture of these two species so very abundant in Icelandic waters.

Although the experiments were very succesfull, yet they only dealt with fish in the colder waters on the north and east coast of Iceland, but gave no information as to the life history of the said species living in the warmer waters on the south and west coast. Therefore it was very desirable to have the experiments extended to the south and west coast of the island. The commission also saw the importance of the matter and the necessity of putting it into execution. Thus the experiments were continued in the years 1908 and 1909. In 1908 Dr. Schmidt visited Iceland on board the »Thor« in June and July and several hundreds of plaice and cod were marked and liberated, chiefly in the Faxe Bay. In 1909. while Dr. Schmidt was engaged in more southern waters, the master of the »Thor«, Capt. G. Hansen, was sent to Iceland, where he marked and liberated a couple of hundred plaice and cod in the Faxa Bay in the months of June and July.

4—5 years have now elapsed since these experiments were carried out, and many of the fishes marked have been recaptured, partly by the native fishermen of Iceland, partly by various foreign, mostly British fishermen, and the marks delivered. Most of these recaptured fish were taken in the two (three) following years whereas in the two last years (1910—1912), with one exeption, no marked fish have been caught, nor marks delivered. As it must thus be assumed that no more of the fish marked during the last experiments, will be recaptured or at least very few, the time can be considered to have arrived, when the results of the experiments should be published.

The most suitable arrangement would doubtless have been for the surveyor of all the marking experiments at Iceland, Dr. Schmidt himself, to give the report of these experiments, but at his request. I have undertaken the task. Although by no means so competent in the matter as Dr. Schmidt, I yet have taken part in the experiments on board the »Thor« on the east coast in 1904, and on the north coast in 1905, and from the first assisted in collecting the marks from fish taken by the Icelanders and by Faroese fishermen fishing in the territorial waters of Iceland. I am thus not without some acquaintance with the matter, a circumstance which made it more difficult for me not to accede to Dr. Schmidt's request.

[1]) Meddel. fra Komm. for Havundersøgelser, Serie Fiskeri, Bd. II Nr. 6, 1907.

The following report will on the whole be written on the same lines as the account of the earlier experiments given by Dr. SCHMIDT in the above mentioned paper. But although my report essentially will be an account of the experiments af 1908 and 1909, it will be necessary also to treat the previous ones, as not a few specimens both of plaice and cod marked in 1904 and 1905 have been retaken since the publication af Dr. SCHMIDT's report. My account will thus partly deal with the experiments on the whole and be divided into three parts: 1) an additional report of the earlier experiments, 2) a report of the experiments of 1908 and 1909 and 3) a summary.

I. An additional report on the marking experiments of 1904 and 1905

In his paper cited above Dr. SCHMIDT has given full particulars of the methods of marking and of the recapture of plaice and cod marked in the years 1904 and 1905. According to these 280 plaice and 473 cod were marked in 1904 and 494 and 517 respectively in 1905. Of all these fish 30 plaice and 38 cod had been retaken when Dr. SCHMIDT published his paper (in the year 1907), the last cod on October 20th 1906 and the last plaice on March 13th 1907. Since that time 17 plaice and 8 cod have been recaptured, and these will be the subject of the following account, where each kind of fish will be treated separately, as done by SCHMIDT in his report.

a. Plaice *(Pleuronectes platessa)* marked in 1905

All the (17) recaptured specimens of this fish were trawled and marked in the Vopna Fjord on the northern part of the east coast (65° 45′ N, 14° 45′ W). SCHMIDT has given a briet description of the conditions of the fjord and the fisheries in it in the paper referred to. The markings were carried out on the 28th and 29th of July 1905[1]) in the presence of the author. The fish marked have been recaptured during the years 1906—1909. These and other particulars concerning their recovery will be seen from the following list.

Supplement list No. I

Particulars of Liberation. Date. Locality. No. of fish. etc.	Particulars of Recovery									
	Date	No. on Label	Sex	Locality reported	Central Position (Approximately)	Fishing Vessel	No. of month between Liberat. and Recovery	Initial Size	Ultimate Size	Sent in by
					N W			cm	cm	
1905	1906 July 12	2023	♀	Vopna Fjord 15 fms.	65°44′ 14°47′	Icel. fish. boat	12	35	?	Jon Gislason, Vopna Fjord
July 28 and 29	— Novbr. 7	2151	♀	3—4 miles E of Ingólfshöfði 30 fms.	63°47′ 16°30′	German S. S.	16	33	35	Kgl. Biol. Anstalt, Helgoland
494 plaice	1907 Aug. 21	2159	♀	5 miles SE ½ E of Langanes 18½ fms.	66°22′ 14°19′	English S. S.	25	30	35.4	Mar. Biol. Assoc., Lowestoft
No. 2001—2494	— — 21	2210	♀	— — — —	66°22′ 14°19′	— —	25	36	42.0	— —
Vopna Fjord.	— — 21	2431	♀	— — — —	66°22′ 14°19′	— —	25	37	44.0	— —
Supplement to	— — 23-27	2388	♀	Iceland	?	— —	25	40	43.9	— —
»Plaice marking	— — 24-28	2251	♀	—	?	— —	25	34	39.5	— —
Experiment	— Septbr. 2	2205	♀	6 miles SE ½ E of Langanes 45 fms.	66°22′ 14°17′	— —	26	39	44.4	— —
B 1905«,	— — 9	2385	♂	7 miles S by W of Vestra Horn 35 fms.	64°10′ 14°50′	— —	26	34	42.6	— —
J. Schmidt	1908 June 3	2275	♀	14 miles ESE of Dalatangi 100 fms.	65°19′ 13°02′	— —	35	35	41.2	— —
(l. c., p. 8)	— — 3	2417	♀	— — — —	65°19′ 13°02′	— —	35	44	52	— —
	— — 9	2024	♀	Found on pontoon. Grimsby	?	— —	35	31	38.9	— —
	— — 17	2214	?	Found in a parcel of fish from Hull	?	— —	35	30	35.6	— —
	— July 7	2423	♀	6 miles NE of Langanes 42—44 fms.	66°29′ 14°24′	— —	36	31	37.8	— —
	— Oktb. 23	2253	?	Found on pontoon. Grimsby	?	— —	39	35	42.5	— —
	— — 31	2232	♂	Found at Brighton, sent from Hull	?	— —	39	39	46.8	— —
	1909 April 28	2031	♀	6 miles SSW ½ W of Langanes 38 fms.	66°17′ 14°28′	— —	45	65	68.0	— —

[1]) cf. SCHMIDT's paper cited above, p. 8.

From the particulars given in the list above, in connection with the information earlier given by SCHMIDT (op. cit.), some interesting conclusions can be drawn.

Rate of growth

The retaken specimens of plaice marked in the Vopna Fjord and recorded by SCHMIDT were not very suitable for illustrating the growth of the plaice on the east coast, as they had only stayed a relatively short time in the sea after liberation, the shortest period of growth being only 4 months, the longest 10 months. On the other hand the 17 specimens in question have lived a relatively long time in the sea after liberation, viz. 12—45 months (1—3¾ year), and most of them two years or more. These specimens therefore provide much better material for the study of the growth of the plaice on the east coast, the more so, as most of them seem to have spent all the time in the colder water[1]) on that part of the coast. This and other details about the growth of the specimens in question will best be seen from the following summary, which is drawn up in analogy to the corresponding ones given by SCHMIDT.

Plaice marking experiments 1905

494 plaice marked 28—29/VII, 1905 in Vopna Fjord in East Iceland (65° 45′ N, 14° 45′ W)

Year and Month recovered	Period of growth (months)	No. of specimens	Average growth in cm.	Least growth in cm.	Greatest growth in cm.	Retaken
1906, November	16	1	2.5	2.5	2.5	East Iceland
1907, August	25	5	6.3	4.4	7.0	South Iceland
— September	26	2	7.5	5.9	9.1	East and South Icel.
1908, June	35	4	6.95	5.6	8.0	East Iceland
— July	36	1	7.3	7.3	7.3	— —
— October	39	2	8.1	7.5	7.8	?
1909, April	45	1	3.5	3.5	3.5	East Iceland

A glance at this summary will show that the average growth on the whole is very slow, being about 2.3 cm. in the year; the greatest annual growth has been 4 cm. in the year, the least 0.9 cm. This remarkably slow growth is shown by the specimen last quoted in the list (No. 2031). which in nearly four years has added only 3.5 cm. to its lenght[2]). This was by far the biggest, and thus probably also the eldest of all the specimens in question, being 65 cm. long when marked, and this circumstance should make the slow growth intelligible. As to the other fish marked in the Vopna Fjord, I must add, that they were all half grown or nearly full grown individuals, being 30—57 cm. long, and the growth spoken of here is that of older individuals, which is, as rule, slower than the growth of younger ones.

If the results reported here are compared with those quoted by SCHMIDT (op. cit. p. 8 and 10), we see that the average rate of growth is nearly the same as regards the previonsly reported plaice, marked in the Vopna Fjord, but in comparison with the growth of the plaice marked in the Skjalfandi Bay, this seems to be considerably greater (about 3.5 cm. in the year). Yet I find the number of the specimens recaptured rather low for drawing any reliable conclusions from this circumstance, which might only be a mere accident. If this again be more, i. e. an expression for a rule, I shall not try to give any plausible explanation of the matter. Perhaps this should be sought in higher temperature on the north coast, perhaps in a greater supply of food, or in both, or in some other unknown cause.

[1]) I must suppose the difference of the conditions of the waters on the opposite sides (the north — east and south — west coasts) of Iceland to be known to the reader, and rest satisfied with referring to the literature in general.

[2]) According to SCHMIDT, op. cit., p. 9, the shrinkage of fish from the time of capture until measured is taken to be 0.5 cm.

Migrations

Concerning the migrations of the 17 specimens of plaice in question, the locality of recapture is unfortunately not communicated for 6 of them, and among these 4 had spent nearly three years in the sea after marking. Of the remaining 11 only one has been retaken at the place where they were liberated, just one year after liberation, and probably it has spent all the time there, without making only longer excursions. All the other specimens were retaken at greater or less distance from the marking place, but as regards their migrations, they have wandered in two quite opposite directions: the majority, or 6 specimens, were taken off Langanes, and have thus wandered northwards, the minority, or 4, have chosen the way to the south coast, while two of them had only reached the mouth of Seydis Fjord, i. e. had not left the east coast at all.

All this is shown on the chart (Fig. 1), and if this be compared with that in SCHMIDT's paper, it will easily be seen, that the migrations of the plaice in question are considerably different from those of the plaice liberated in the Vopna Fjord and shown on SCHMIDT's chart. The majority (11) of these were retaken off the south coast, whilst 5 were retaken in the very fjord, in which they were liberated.

If the rate of speed at which the plaice in question have migrated, be compared with that of the individuals reported by SCHMIDT (op. cit., p. 10), it will be seen that the individuals reported by me have migrated much more slowly than those reported by SCHMIDT. The specimen which has covered the greatest distance from the place of liberation (marked on the chart Fig. 1 as G 16) is also the one, which has migrated at the greatest rate of speed, having covered 190 miles in 16 months (recaptured near Ingolfs Höfdi), or nearly 0.4 mile pr. day, whereas the fastest moving specimen recorded by SCHMIDT made 1.4 miles pr. day. All the other individuals in question had made far shorter distances, in spite of a longer sojourn in the sea, and those which had spent the longest time (25—45 months) in the sea after liberation had only reached Langanes, ɔ: only moved 30—40 miles from the place of liberation.

With two exceptions, all the specimens in question, the locality of recapture of which has been communicated by the fishermen, have been retaken in a distance of less than 60 miles from the place of liberation and as they have stayed 2—3 years in the sea, it can fairly be said, that they have been stationary in the cold water of the east coast or been very slowly moving from the place where they were marked and liberated. Though the possibility is not excluded that they in the meantime had wandered farther away, perhaps to the warmer waters, and again visited their old feeding grounds during the warmer season.

Intensity of the plaice fishery

Of the plaice marked in the Vopna Fjord 33 specimens or 6.67 % have been recaptured till now, and with one exception, all the specimens recorded in this paper have been taken by English fishermen (provided that the specimens »found on pontoon« in English seaports also have been caught by the English). If the experiments in 1904 and 1905 are taken together, 47 individuals, or 6.07 % have been recaptured, most of them by British fishermen. The proportion of catches according to nationality will be this (cf. SCHMIDT op. cit. p. 13):

Retaken by	British fishermen	. . . 35	or 74.47 %
— -	German —	. . . 6	- 12.77 %
— -	Icelandic —	. . . 6	- 12.77 %

Again these figures illustrate the predominating position of the British fishermen in reference to the plaice fishery in Iceland waters.

Fig. 1. Marking Experiments on plaice. Vopna Fjord, July 1905. Supplementary chart. Northwest Iceland, July 1908. Experim. I & J.

Here and on the following charts ● indicates the locality where plaice were captured, ⊙ indicates the locality when plaice were liberated, —→ indicates the locality where a marked plaice has been recaptured by British [E], Danish [Da], Dutch [D], Faeroic [F], French [Fr], German [G] and Icelandic [Ic] fishermen. The number of months between liberation and recovery is indicated by a cipher next to the mark of nationality [E 5, etc.].

b. Cod *(Gadus callarias)* marked in 1904 and 1905

I mentioned above that 8 specimens of cod marked in the years 1904 and 1905 had been recaptured since the publication of SCHMIDT's report. One of these specimens, marked in the Lodmundar Fjord in 1904, was washed ashore on the south coast, but unfortunately the head only, as the fish apparently had been killed and, except the head, devoured by a seal. (Supplement list No. II A). The other 7 were marked in the Skaga Fjord on the north coast in 1905 and recaptured as recorded in the following list. (Supplement list No. II B).

Supplement list No. II

Particulars of Liberation. Date. Locality. No. of fish. etc.	Particulars of Recovery									
	Date	No. on Label	Locality reported	Central Position (Approximately)	Fishing Vessel	No. of month between Liberat. and Recovery	Initial Size	Ultimate Size	Sent in by	Remarks
				N W			cm	cm		
A. 1904 July 25 Lodmundar Fjord 297 cod 65°21.5′ N 13°42′ W Supplement to »Cod marking Experiment A 1904«, J.Schmidt (l. c., p.14)	1910 March 9	1697	Breidamerkursandur	64°04′ 16°05′	washed ashore	67	62	. .	Bjarni Sæmundsson, Reykjavik	head only
B. 1905 Aug. 10—18 376 cod No. 2601—2976 Skaga Fjord 66°01′ N 19°32′ W Supplement to »Cod Marking Experiment C. 1905«, J. Schmidt (l. c., p. 19)	1906 July 10	2842	Huna Bay, Vatnsnes 120 fms.	65°45′ 20°41′	Icel. fish boat	11	52	(56.5)[1]	Bjarni Sæmundsson, Reykjavik	
	— — 27	2888	Huna Bay, 5 miles WNW of Kalfshamarsnes	66°02′ c. 20°35′	— —	11	56	(59.2)[1]	— —	
	— Aug. 15	2794	Off Siglunes 5 fms.	66°13′ c. 18°48′	— —	12	41	(40.5)[1]	— —	
	1907 April 10	2724	The month of Isafjord Deep c. 20 fms.?	66°13′ c. 23°22′	— —	20	42	(61.5)[1]	— —	
	— June 5	2800	Faxa Bay, 2 miles NE of Gardskagi 18 fms.	64°07′ 22°38′	— —	22	60	(73)[1]	— —	
	— Aug. 6	2935	Breida Fjord, 7 miles SE of Skor 40 fms.	65°18′ c. 23°49′	— —	24	42	(59.5)[1]	— —	
	— Okt. 13-14	2604	Western part of Skaga Fjord		— —	26	67	(57.5)[1]	— —	

The Suppl. list No. II A is somewhat short, as it only contains one specimen, marked and liberated in the Lodmundar Fjord 1904; moreover the specimen was so badly damaged that its recovery only gives information about its migration, and this is interesting enough, as it is the only case of cod, marked on the east coast having reached the south coast. Further it is the specimen of cod which has stayed the longest time in the sea after liberation, viz. 5 years and 7 months, and would surely have given very important informations of the growth, if it had been in a complete state.

All the fishes, particulars of which are given in the Supplement list No. II B, were marked and liberated in the Skaga Fjord August 10th—18th 1905 together with 375 others, as recorded by Dr. SCHMIDT, op. cit., p. 19. The specimens in question have all been retaken by Icelandic open boats or (in one case) smacks and the marks collected by the author; this was also the case with the 8 specimens previously recaptured and reported by SCHMIDT. Concerning these 8 specimens and two others, marked in the Eyja Fjord SCHMIDT made (l. c.) following remark: »marks may possibly come in later, and in any case to judge from the other experiments this experiment can scarcely be considered as concluded«, and he did not draw any further conclusions from the information as to the biology of these fish, gained by their recapture.

The last of the specimens reported by SCHMIDT were recaptured on October 20th 1906; the last of the specimens reported in this paper were caught in the middle of October 1907; since that 6 years

[1]) resp. »21, 22½, 15½, 23½, 28, 23¾, 22 Da inches«.

have elapsed and there is no reason to expect the reappearance of any more specimens of the cod marked in 1905. Therefore I now find a closer examination of the particulars concerning the recapture of all these fish, marked in the Skaga Fjord, advisable.

Rate of growth

SCHMIDT has not recorded the ultimate size of the cod recovered and reported by him; but as I have noted these figures in my journal at the reception of the marks, I shall give evidence as to the growth of all the fish recaptured. Unfortunately the measurement of the ultimate size of one of the specimens is too inaccurate (the ultimate size being less than the initial size) to be taken in consideration [1]). The initial and the ultimate size of the fish recorded by SCHMIDT are as follows:

Number of cod marked	Number of months in the sea	Initial size in cm	Ultimate size in cm
2925	0	51	51
2737	1	49	37
2898	9	46	49
2748	9	50	56
2692	11	41	48
2658	12	42	52
2912	14	52	62
2509	14	41	41

All the cod marked in the Skaga Fjord were small or medium-sized fish (Icel. »Þyrsklingur« and »stútungur«) being 41—67 cm in length and probably belonging to the age-groups III—V (3—5 years old). Thus they have been in the period of life, when the growth is at the height of rapidity, or just beginning to decrease. Most of the fish in question have spent one or two years in the sea between the time of liberation and recapture. Otherwise the details concerning the growth will be seen from the following summary, which is drawn in the same manner as that previously given about the plaice.

Cod marking experiments 1905

391 cod marked 10—18/VIII, 1905 in Skaga Fjord in North Iceland (66° 01′ N, 19° 32′ W and 65° 56′ N, 19° 26′ W)

Year and Month recovered	Period of growth (months)	No. of specimens	Average growth in cm.	Least growth in cm.	Greatest growth in cm.	Retaken
1905, August	0	1	0.5 [2])	0.5	0.5	Skaga Fjord
1906, May	9	2	5.0	3.5	6.5	Isafjord Deep
1906, July	11	3	5.3	3.5	7.5	North Iceland
1906, August	12	1	10.5	10.5	10.5	— —
1906, October	14	2	9.0	8.5	10.5	— —
1907, April	20	1	20.0	20.0	20.0	Isafjord Deep
1907, June	22	1	13.5	13.5	13.5	Faxa Bay
1907, August	24	1	18.0	18.0	18.0	Breida Bay

It will be seen from this list of cod marked and liberated in North Iceland water and retaken on the north, northwest and west coasts of the island, that the average annual growth is somewhat slow, being some 8 cm in the year. Some specimens have added 10.5 cm to their length in the same space of time, while others have only increased by some 4 cm. Though on the whole the growth is not nearly so rapid as in the cod marked and liberated on the southwest coast (see below), yet the specimens recovered and accurately measured are too few, as to be a reliable base for any further conclusions concerning the growth.

[1]) This is probably due to the circumstance that the Icelandic fishermen measure the cod from the head to the base of the caudal when classifying it for trade.

[2]) As previously the shrinkage from capture to measurement is taken to be 0.5 cm.

—— 40 Meter. —·—·— 100 Meter. —··—··— 200 Meter.

Fig. 2. Marking Experiments on cod.
Lodmundar Fjord July 1904. Skaga Fjord August 1905. Skjálfandi Bay July 1908. Experim. A.

Migrations

It can easily be seen from the lists and the chart (Fig. 2) concerning the recovery of the cod marked in the Skaga Fjord that the majority of the 15 specimens retaken have migrated out of the fjord where they were marked. Three individuals only were taken within the fjord. Of the 12 migrating specimens again two have wandered eastwards, while all the others have taken their way towards west and south; some of them have only reached the neighbouring Huna Bay or the more distant Isafjord Deep, whilst two have been caught in the Breida Bay and the southern part of the Faxa Bay respectively. Thus the tendency to seek the warmer waters of the west and the southwest coasts is evident as for the majority of the fish or, in other words, fish, which have spent their period of growth in the colder water on the north coast, seek their breeding (spawning) grounds on the west or southwest coast.

The rate of speed at which the cod have migrated has been pretty different. The specimen that had spent the longest time (26 months) in the sea after liberation was retaken only some 9 miles distant from the marking place, while others had reached the Isafjord Deep, the Breida Fjord or even crossed the Faxa Bay in a shorter time, i. e. 9—24 months. The greatest speed was made by two specimens, which covered the distance of 120—130 miles (retaken in the Isafjord Deep) in 9 months, which means c. 0.5 mile pr. day. The two individuals that reached the Breida and the Faxa Bay, a distance of 190 and 270 miles respectively, made the journey in a relatively longer time (at a lower rate of speed), ɔ: in 24 and 22 months.

8 specimens had not left the north coast at all, being retaken in a distance of 50 miles or less from the marking place (with one exception) 11—26 months after liberation. These specimens may be considered to have stayed all the time on the north coast, although longer migrations are not excluded (cf. the above mentioned about the migrations of the plaice).

A glance at chart (Fig. 2) will show that all the fish recaptured have been caught in the vicinity of the coast, none being taken at a greater distance from the coast than 6 miles. From this fact we may suppose that the fish as a rule have lived in the coastal (shallower) waters in these years, and with one exception they have been taken by open boats.

Intensity of the cod fishery etc.

Of the 26 cod marked and set out in the Eyja Fjord in August 1905 only the two specimens reported by Schmidt (op. cit., p. 19, List D), or 7.8 % had been recovered before the end of October the same year and no more have been caught hitherto. Of the 391 fish marked and liberated in the Skaga Fjord in the same month, only 8 specimens or 2.05 % had been recovered when Schmidt published his paper. Since that time and up to date 7 specimens are added to the number of fish recovered. Thus on the whole only 15 specimens, or 3.84 %, of the Skaga Fjord cod have been recaptured, which can hardly be said to be any heavy taxation of the stock of fish. This as well as the circumstance that only two specimens were retaken during the first 9 months after marking, may be explained by the fact that in the tract, where the fish were set out, no intensive fishery is carried out by the natives (forreign fishermen are excluded), and during the winter and spring (December—May) as a rule no cod fishery at all takes place.

Another point of interest is the fact that all the recaptured specimens of cod marked and liberated on the north coast have been taken by Icelanders and, with one exception by open boats. Perhaps some specimens have been taken by foreign fishermen outside the territorial limit, but no marks have hitherto been delivered. This fact also supports the conjecture that the fish mainly have lived near the coast, in the territorial waters.

II. The marking experiments of 1908 and 1909

In the introduction to this paper I recorded shortly these experiments together with the earlier ones. As mentioned there the research-steamer »Thor«, with Dr. SCHMIDT on board, visited Iceland in the months of June and July 1908, and among other work carried out during this trip, 605 plaice and 27 cod were marked; the greater part of the plaice were marked and liberated at different localities in the Faxa Bay on the southwest coast, in the later half of June, the remainder partly off the mouth of Patricks Fjord, partly off the Bardinn promontory on the northwest coast, in the middle of July, but the cod were marked in the Skjalfandi Bay on the north coast some days later. The marking experiments of 1909 again were, as mentioned at first, accomplished by the experienced master of the »Thor« capt. G. HANSEN, assisted by one of his crew. Hansen and his assistent went on board an Icelandic steam trawler, which was engaged in fishing on the banks in the southern part of the Faxa Bay, and procured the fish necessary for marking. These experiments were restricted to the Faxa Bay and carried out in the period from June 27th to July 9th, and comprised both plaice and cod, 200 of each, which were set out at different localities in the bay.

As to myself, I must mention, that I did not partake in any of these experiments, as I was engaged during the periods, when they were carried out, partly by official duties, partly in fishery investigations in the coastal waters on the northwest and the west coast, but as formerly, I have collected the marks from the fish recaptured by Icelandic fishermen.

Of the 1032 marks affixed to 805 plaice and 227 cod hitherto only 279 have been delivered, 248 from plaice, 31 from cod, which means 30.93 % recaptured of the marked plaice and 13.66 % of the marked cod. But these figures are not the true expression for the real capture, as there are doubtless a number of marks which have never been delivered. I myself know of three cases from Icelandic fishermen, where the marks from retaken fish have not been delivered[1]), and I have been told of many such cases from English fishermen. As I had been informed of this neglect on the part of the fishermen, I drew up and inserted in different Icelandic newspapers a notice to the Icelanders, wherein I called upon them to deliver without delay the marks of any fish, which they might catch.

A. Marking experiments on plaice *(Pleuronectes platessa)*

As mentioned above, several hundreds of plaice were marked and liberated during the cruise of the »Thor« in Icelandic waters in June and July 1908. By far the greatest part of these fish were marked and liberated in the Faxa Bay, whilst some seventy were marked and set out off the northwest coast. In 1909 again two hundred plaice were marked by Capt. HANSEN in the Faxa Bay. Thus these experiments fall into two groups: the experiments in the Faxa Bay and the experiments on the north west coast.

1. Experiments in the Faxa Bay

These experiments were carried out in different localities, partly by SCHMIDT, on board the »Thor« in the period from June 16th to 27th 1908, partly by HANSEN, on board an Icelandic trawler in the period from June 30th to July 9th 1909.

Before treating these experiments further, a short description of the bay where the experiments were carried out, will be necessary.

[1]) In two of these cases the fish in question were cod. One of them was caught in a gill net off Stokkseyri on the south coast (e. 63° 44′ N, 21° 05′ W), 40 fms, on the 19th of April 1911. The label went away as the fish was taken in. The second is said to have been taken off Patricks Fjord. In the third case the fish was a plaice, taken by a trawler off Stödvar Fjord on the east coast.

As will be seen from the charts, the Faxa Bay is the southernmost of the two great bays on each side of the Snæfellsnes-peninsula on the west coast of Iceland. It is an open and relatively short bay, and on the whole rather shallow, the depths for the greatest part being 40—50 metres or less. The southern part of the bay is occupied by two banks, named Vestra hraun and Sydra hraun, with very shallow water (15—20 metres) and hard and rough bottom, as a rule unfit for trawling. Apparently great quantities of very young cod (the 0- and I-group) live on these banks, feeding on small crustaceans and other lower animals. On the slopes of these banks and in the inner (shallower) parts of the bay the bottom is sandy or covered with fragments of shells and yields an excellent feeding ground for myriads of sandeels and great quantities of plaice, young halibut and other flat fishes. The sandeels again form the favourite food for millions of cod and haddock of different ages, which visit the bay during the warmer season. Besides this great quantities of adult cod seek these tracts in the spring for the spawning.

From this it will easily be understood that there are many excellent fishing grounds in this bay. Especially the slopes of the Sydra hraun (the northeast, east and southeast slopes are called Svidid) have been frequented by the native fishermen from the earliest times. Since 1895 the bay has been visited on a constantly increasing scale by steam trawlers of every nationality, especially British and French; these have totally occupied the old fishing banks of the natives, as they unfortunately lie outside the territorial limit, and here annually take great quantities of fish of different kinds. Thus the conditions in the Faxa Bay are in many respects similar to those in the North Sea.

The shallow bays, which are cutting into the land from the main bay, as the estuary Borgar Fjord, the Kolla Fjord etc., yield very good breeding places for young plaice and dab, whilst the narrow and deep Hval Fjord is very poor in fish of every kind. The young plaice feeding here have no doubt immigrated in the earliest stages of their life from the deeper water farther out, perhaps outside the bay.

After these introductory remarks, I will proceed to treat the experiments in question. The bulk of the marked plaice were medium-sized, and probably adult fish, being 27—35 cm long, whereas the extremes measured 23 and 53 cm. All the fish marked were trawled in moderate depths, 15—25 fms. In some cases the fish were liberated at the place where they were captured, but in others they were carried away to remote places, where no plaice fishery at all is practised, and liberated there. This was done in order to save the liberated fish from being too quickly recaptured, which would ineviteably have been the case, if they had been set out on the banks, where the intensive trawl fishery is going on. The localities, where the marked plaice were caught and liberated are joined on the charts by stippled lines, and their situations are indicated in following table.

Experiments	Date	Locality of capture	Locality of liberation
Exp. A.	1908, June 16, 18, 19.	64° 16′ N, 22° 17′ W, 20—35 fms.	64° 16′ N, 22° 17′ W, 6 miles SW of Akranes 8—9 fms.
— B.	— — 22, 23.	64° 01′ N, 22° 30′ W, 17 fms.	64° 01′ N, 22° 30′ W, off Keflavík 12 —
— C.	— — 23.	64° 01′ N, 22° 30′ W, 17 —	Hval Fjord, off Mariuhöfn ?
— D.	— — 25, 26.	64° 16′ N, 22° 17′ W, 25 —	64° 02′ N, 22° 11′ W, Vatnsleysuvík 19 fms.
— E.	— — 27.	64° 02′ N, 22° 33′ W, 17 —	Hval Fjord, off Mariuhöfn ?
— F.	— — 30.	64° 10′ N, 22° 16′ W, 15 —	64° 10′ N, 22° 13′ W, 11 miles NW of Grotta Light ?
— G.	1909, July 5.	64° 10′ N, 22° 16′ W, 15 —	64° 11′ N, 21° 51′ W, between Engey and Videy 14 fms.
— H.	— — 9.	64° 13′ N, 22° 09′ W, 20 —	64° 12′ N, 21° 58′ W, 2 miles NE of Grotta Light 18 —

Other particulars concerning the liberation and the recaptures of the fish will be seen from the lists A—H and from the charts (Fig. 3—5).

Particulars of Liberation. Date. Locality. No. of fish. etc.	Particulars of Recovery										
	Date	No. on Label	Sex	Locality reported	Central Position (Approximately)	Fishing Vessel	No. of month between Liberat. and Recovery	Initial Size	Ultimate Size	Sent in by	
					N W			cm	cm		
Experiment A	1908 June 17-21	4002	♀	Faxa Bay, 8 miles NW by W of Akranes 24 fms.	64°18′ 22°22′	English S. S.	?	37	38.0	Mar. Biol. Assoc., Lowestoft	
1908	— — —	4006	♂	— — — —	64°18′ 22°22′	— —	0	28	29.0	—	—
June 16—19	— — —	4013	♀	— — — —	64°18′ 22°22′	— —	0	36	35.9	—	—
96 plaice	— — —	4044	♂	— — — —	64°18′ 22°22′	— —	0	34	34.2	—	—
No. 4001—4096	— — —	4048	♂	— — — —	64°18′ 22°22′	— —	0	44	33.7	—	—
Faxa Bay	— — —	4073	♂	— — — —	64°18′ 22°22′	— —	0	33	32.1?	—	—
64° 16′N 22°17′ W	— — —	4080	♂	— — — —	64°18′ 22°22′	— —	0	25	25.0	—	—
Depth	— — 20	4051	♂	— 6 miles W Akranes 21-22 fms.	64°15′ 22°15′	— —	0	37.5	37.3	—	—
8—9 fms.	— — 21	4014	♂	— 5 miles NW of Akranes 30 fms.	64°20′ 22°20′	— —	0	30	30.2	—	—
	— — —	4055	♂	— 6 miles W from Akranes 21-22 fms.	64°15′ 22°15′	— —	0	35.5	34.8	—	—
	— — —	4058	♀	— — — —	64°15′ 22°15′	— —	0	40	39.3	—	—
	— — 22	4018	♀	— 5 miles WNW of Akranes 23 fms.	64°17′ 22°13′	— —	0	35	36.2	—	—
	— — —	4019	♀	— — — —	64°17′ 22°13′	— —	0	32	32.8	—	—
	— — —	4020	♀	— — — —	64°17′ 22°13′	— —	0	32	c. 32	—	—
	— — —	4034	♀	— — — —	64°17′ 22°13′	— —	0	37	37.1	—	—
	— — —	4042	♀	— — — —	64°17′ 22°13′	— —	0	37	37.1	—	—
	— — —	4070	♂	— — — —	64°17′ 22°13′	— —	0	32	33	—	—
	— — 25	4077	♂	— 5 miles NW 3/4 W of Akranes 30 fms.	64°19′ 22°20′	— —	0	27	25.5	—	—
	— — 27	4030	♂	— — — —	64°19′ 22°20′	— —	0	41	39.8	—	—
	— — —	4037	♀	— 5 miles NW by W of Akranes 24 fms.	64°18′ 22°15′	— —	0	38	36.4	—	—
	— - last part of	4083	♂	Faxa Bay		Iceland S. S.	0	29	?	B. Sæmundsson, Reykjavik	
	— July 1	4009	♀?	— 12 m. NW1/3N of Grotta Light 22 fms	64°15′ 22°19′	— —	1	28	27.5	—	—
	— — —	4017	♂	— — — —	64°15′ 22°19′	— —	1	31	30.5	—	—
	— — 9	4022	♂	— 13 miles NW 1/2 W of Hjörtsey 36 fms.	64°32′ 22°50′	English S. S.	1	32	32.4	Mar. Biol. Assoc., Lowestoft	
	— — 16	4064	♂	Found on pontoon. Grimsby		— —	1	30	30.3	—	—
	— — 20	4003	♂	— —		— —	1	32	32.6	—	—
	— — —	4074	♂	— —		— —	1	31	31.9	—	—
	— — 22	4005	♂	Faxa Bay, 5 miles WNW of Akranes 23 fms.	64°17′ 22°13′	— —	1	38	39.0	—	—
	— — —	4023	♂	— — — —	64°17′ 22°13′	— —	1	33	33.8	—	—
	— — —	4032	♀	— — — —	64°17′ 22°13′	— —	1	36	37.1	—	—
	— — —	4034	♀	— — — —	64°17′ 22°13′	— —	1	37	37.1	—	—
	— — —	4038	♂	— — — —	64°17′ 22°13′	— —	1	38	37.5	—	—
	— — —	4039	♂	— — — —	64°17′ 22°13′	— —	1	30	31.1	—	—
	— — —	4040	♂	— — — —	64°17′ 22°13′	— —	1	28	28.2	—	—
	— — —	4075	♂	— — — —	64°17′ 22°13′	— —	1	29	29.8	—	—
	— — 23	4043	♂	— 8 miles NW by W of Akranes 24 fms.	64°18′ 22°20′	— —	1	46	47.1	—	—
	— — 28	4062	♂	— 8 m. WNW 1/2 W of Akranes 21 fms.	64°16′ 22°20′	— —	1	33	(31.7) [1]	—	—
	— Aug. 9	4046	♀	— off Akranes 22 fms.	64°17′ c. 22°15′	— —	2	33	?	—	—
	— — —	4050	♀	— — —	64°17′ c. 22°15′	— —	2	28	?	—	—
	— — 10-15	4007	♂	Faxa Bay		— —	2	35	?	—	—
	— — 20-24	4045	♂	—		— —	2	34.5	36.7	—	—
	— — 26	4061	♂	Found on pontoon. Grimsby		— —	2	36.5	38.2	—	—
	— Sept. 3	4094	♂	— —		— —	3	26.5	29.0	—	—
	— — 9	4004	♀?	— —		— —	3	33	36.2	—	—
	— — 13	4059	♀	Faxa Bay, c. 8 m. NW of Grotta Light 20 fms.	64°11′ 22°17′	Iceland S. S.	3	29.5	32	B. Sæmundsson, Reykjavik	
	— — 15	4065	♀	— 10 m. WNW 1/2 N of Akranes 24 fms.	64°17′ 22°27′	English S. S.	3	29	34.1	Mar. Biol. Assoc., Lowestoft	
	— — —	4052	♀	— 8 m. WNW 1/2 W of Akranes 20 fms.	64°16′ 22°20′	— —	3	33.5	36.6	—	—
	— — 27	4071	♂	— 10 m. NW 1/2 W of Akranes 26 fms.	64°19′ 22°25′	— —	3	29	33.5	—	—
	— — 30	4079	♂	Faxa Bay		— —	3	35	38.2	—	—
	1909 March 29	4024	♂	26 miles NW by W of Bardinn 33 fms.	66°15′ 24°45′	— —	9	38	39.5	—	—
	— April 18	4001	♀	Faxa Bay, 9 m. WNW 1/4 W of Akranes 20 fms.	64°16′ 22°22′	— —	10	30	34.5	—	—
	— — 28	4036	♀	— 14 m. NW 1/4 W of Akranes 35 fms.	64°20′ 22°35′	— —	10	28	30.8	—	—
	— — 30	4089	♂	Found on pontoon. Grimsby		— —	10	27	29.9	—	—
	— Aug. before 5	4082	♀?	— —		— —	14	28	?	—	—

[1]) »12 1/2 Da. inches«.

Particulars of Liberation. Date. Locality. No. of fish. etc.	Particulars of Recovery									
	Date	No. an Label	Sex	Locality reported	Central Position (Approximately)	Fishing Vessel	No. of months between Liberat. and Recovery	Initial Size	Ultimate Size	Sent in by
					N W			cm	cm	
Experiment B	1908 Sept. 4	4176	♂	Found on pontoon. Grimsby		English S. S.	3	38	37.8	Mar. Biol. Assoc., Lowestoft
1908	— Oct. 11	4183	♂	Faxa Bay, 4 miles of Gardskagi light 24 – 25 fms.	64°05′ 22°48′	— —	4	38	40.2	— —
June 22 and 23	1909 March 2	4121	♂	Found on pontoon. Grimsby		— —	9	34.5	34.7	— —
100 plaice	— — 8	4125	♂	12 miles SW of the Westman Islands 90 fms.	63°15′ 20°20′	— —	9	34.5	?	— —
No. 4097—4196	— — 22	4100	♂	Found in London probably from Hull or Grimsby		— —	9	31.5	33.0	— —
Faxa Bay 64°01′ N 22°30′ W	— April 4	4107	♀	Faxa Bay, 8 miles WNW $^1/_2$ W of Akranes 22—25 fms.	64°16′ 22°20′	— —	10	35.5	38.8	— —
Depht 12 fms.	— May 15	4113	♀	Found on pontoon. Grimsby		— —	11	32.5	36.6	— —
	— — 22	4181	♂	Faxa Bay, 19 miles SSE $^1/_4$ S of Stapi 36 fms.	64°35′ 23°02′	— —	11	37.5	41.5	— —
	— Aug. 4	4146	♂	Found on pontoon. Grimsby		— —	14	31	33.7	— —
	— Dec. 19	4180	♀	NW Iceland, 12 miles NW by W of Bardinn 47 fms.	c.66°05′24°15′	— —	18	36	37.5?	— —
	1910 March 21	4129	♀	Faxa Bay, 5 miles NWN $^1/_2$ N of Gerdatangi Light 28 fms.	c.64°06′22°22′	Icel. op. boat	21	27	29.2	B. Sæmundsson, Reykjavik
	— — c. 30	4111	♂	Found on pontoon. Grimsby		English S. S.	21	35	37.1	Mar. Biol. Assoc., Lowestoft
Experiment C	1908 Sept. 24	4216	♀	Faxa Bay, c. 4 miles W of Akranes, 23 fms.	64°15′ 22°10′	Iceland S. S.	3	41	44	B. Sæmundsson, Reykjavik
1908 June 23	1909 May 14	4232	♀	Faxa Bay by Akranes, 8 fms.	64°18′ c.22°08′	Icel. op. boat	11	28	26	— —
81 plaice										
No. 4197—4277										
Hvalfjord off Mariuhöfn										
Experiment D	1908 Aug. 2	4333	♂	Faxa Bay, 8 miles E $^1/_2$ N of Gardskagi 15 fms.	64°10′ 22°27′	English S. S.	2	33.5	35.5	Mar. Biol. Assoc., Lowestoft
1908	— — 9	4403	♀	Faxa Bay, Akranes Bank, Iceland 22—24 fms.	64°17′ 22°18′	— —	2	27	28.7	— —
June 25 and 26	— Sept. 10	4343	♂	Faxa Bay, 7 miles E by N of Gardskagi 17 fms.	64°09′ 22°30′	— —	3	30	32.4	— —
136 plaice	— — 26	4324	♀	Faxa Bay, 6 miles W. of Akranes 23 fms.	64°15′ 22°17′	— —	3	29		— —
No. 4278—4413	1909 March 17	4329	♂	12 miles W by N of the Westman Islands 46 fms.	63°22$^1/_2$′ 20°39′	— —	9	44		— —
Vatnsleysuvik 64°02′ N 22°11′ W	— — 26	4322	♀	10 miles NNW. of Skalavik 50 fms.	66°18′ 23°50′	— —	9	30.5		— —
Depht 19 fms.	— April 5	4293	♂	Faxa Bay, 12 miles NW of Akranes, 36 fms.	64°20′ 22°30′	— —	10	28	29.3	— —
	— — 18	4334	♂	Faxa Bay, 9 miles WNW $^1/_4$ W of Akranes 20 fms.	64°16′ 22°22′	— —	10	34	37.7	— —
	— — 20	4354	♂	15 miles SW of the Westman Islands 90 fms.	63°12′ 20°21′	French S. S.	10	43	41	Dr. Ad. Cligny, Boulogne
	— — 22	4345	♀	Faxa Bay, 8 miles NW of Grötta c. 20 fms.	64°13′ 22°22′	Iceland S. S.	10	34	36	B. Sæmundsson, Reykjavik
	— May 4	4301	♂	28 miles NW $^3/_4$ W of the Westman Islands 65 fms.	63°28′ 21°18′	English S. S.	11	38	40.2	Mar. Biol. Assoc., Lowestoft
	— — 5	4386	♀	Faxa Bay c. 30 fms.	64°20′ 22°34′	Icel. op. boat	11	28.5	33	B. Sæmundsson, Reykjavik
	— — 13	4363	♀?	Faxa Bay off Njardvik 5—6 fms.	63°59′ 22°35′	— —	11	32	(28)[1]	— —
	— — 21	4298	♂			English S. S.	11	24	31.5?	Mar. Biol. Assoc., Lowestoft
	— — 24	4331	♀	Faxa Bay, 4 miles S of Akranes 20 fms.	64°16′ 22°15′	— —	11	32.5	35.7	— —
	— June 10	4387	♂	Found on pontoon. Grimsby		— —	12	27.5	30.9	— —
	— July 5	4303	♂	Faxa Bay 8 miles ESE of Gardskagi 22 fms.	64°06′ 22°20′	— —	13	39	42.3	— —
	— — 30	4290	♂	Faxa Bay, 4 miles E by S of Gardskagi 20 fms.	64°07′ 22°30′	— —	13	26.5	34.0	— —
	— Nov. 5	4306	♀	Hull		— —	17	29.5		— —
	— Dec. 7	4398	♀	Found on pontoon. Grimsby			18	24.5	30.0	— —
	1910 April 1	4313	♀	Faxa Bay, 4 miles NE of Gerdatangi Light 26 fms.	64°05′ 22°21′	Icel. op. boat	22	29	(26)[2]	B. Sæmundsson, Reykjavik
	— May 3	4373	♀	Faxa Bay, 8 miles NNW of Grötta Light c. 15 fms.	64°12′ 22°16′	Iceland S. S.	23	26	33.5	— —
	— — 5	4402	♀	Found on pontoon. Grimsby		English S. S.	23	26	30.9	Mar. Biol. Assoc., Lowestoft
	— — 6	4279	♀	— — —		— —	23	28	30.8	— —
	— — 15	4284	♀	Faxa Bay, 12 miles NW of Akranes	64°20′ 22°30′	— —	23	27.5	30.3	— —
	— — 15	4320	♂	Faxa Bay		— —	23	29	32.7	— —
	— June 6	4401	♂	Faxa Bay, c. 3 miles SE of Gardskagi c. 25 fms.	c.64°06′22°36′	Dutch S. S.	24	23	38	B. Sæmundsson, Reykjavik
	— July 17	4366	♀	18 miles WNW of Bjargtangar 38 fms.	65°25′ 25°10′	English S. T.	25	33.5	45.5	Mar. Biol. Assoc., Lowestoft
	— Sept. 8	4344	♂	5 miles WNW of Gardskagi 25 fms.	64°03′ 22°50′	— —	27	32	40.6	— —
	— — 13	4370	♀	Faxa Bay, off Keflavik 10 fms.	64°01′ 22°29′	Icel. op. boat	27	26.5	30	B. Sæmundsson, Reykjavik

[1]) »10 Da. inches«.

[2]) exc. tail.

Particulars of Liberation. Date. Locality. No. of fish. etc.	Particulars of Recovery									
	Date	No. on Lab	Sex	Locality reported	Central Position (Approximately) N W	Fishing Vessel	No. of month between Liberat. and Recovery	Initial Size cm	Ultimate Size cm	Sent in by
Experiment E	1908 July 22	Da. 8.402	♀	Faxa Bay, off Borgarfjord 31 fms.	64°21′ 22°18′	English S. S.	1	37		Mar. Biol. Assoc., Lowestoft
1908 June 27	— Aug. 1	Da. 8.410	♂	Faxa Bay, 5 miles NW of Grotta 17 fms.	64°10½′ 22°10′	— —	2	30	(28)[1]	— —
119 plaice	— — 4	4482	♂	Faxa Bay, 7 miles WNW ¼W of Akranes 21—22 fms.	64°17′ 22°20′	— —	2	42	43.4	— —
No. 4414—4500										
Da. 8.401—432	— — —	4485	♂	— — — —	64°17′ 22°20′	— —	2	31	31.9	— —
Hvalfjord	— — 7	4427	♂	Faxa Bay, c. 5 miles WNW of Akranes 22—24 fms.	64°17′ 22°18′	— —	2	32	31.5	— —
off Mariuhöfn	— — 12	4452	♀?	Found on pontoon, Grimsby		— —	2	37	38.1	— —
	— — 13	4494	♀	Faxa Bay, c. 5 miles WNW of Akranes 23 fms.	64°17′ 22°18′	— —	2	34	34.8	— —
	— — 20	4464	♀	Faxa Bay, 15 miles W of Akranes about 30 fms.	64°25′ 22°35′	— —	2	42	43.1	— —
	— — 28	4478	♂	Sent to Wolverhamton from Grimsby		— —	2	31		— —
	— Sept. 2	4425	♀	Found on pontoon. Grimsby		— —	3	32.5	34.2	— —
	— — —	4474	♂	— — —		— —	3	32.5	33.4	— —
	— — —	4495	♂	— — —		— —	3	32.5	33.7	— —
	— — —	Da. 8.407	♂	— — —		— —	3	31.5	32.9	— —
	— — 16	4492	♂	Faxa Bay, 17 miles NW ½W of Akranes 28 fms.	64°20′ 22°43′	— —	3	34.5	36.3	— —
	— — 20	4449	♀	Faxa Ray, c. 5 miles N of Gardskagi 28 fms.	64°09′ 22°48′	Iceland S. S.	3	34	36	B. Sæmundsson, Reykjavik
	— — 22	4447	♂	Found on pontoon. Grimsby		English S. S.	3	33	35.2	Mar. Biol. Assoc., Lowestoft
	— — 25	Da. 8.416	♂	— — —		— —	3	30	32.6	— —
	— — 26	4431	♀	Faxa Bay, 6 miles W ¼N of Akranes 23 fms.	64°15′ 22°17′	— —	3	33	?	— —
	1909 Febr. 16	Da. 8.406	♂			— —	8	40	39.1	— —
	— March 13	Da. 8.404	♀	7 miles SW of the Westman Islands 70 fms.	63°20′ 20°15′	— —	9	53	55.6	— —
	— — 28	4422	♂	21 miles WNW of the Westman Islands 62 fms.	63°24′ 21°00′	— —	9	47	48.9	— —
	— April 22	4421	♀	Faxa Bay, 8 miles NW of Grotta Light 20 fms.	64°13′ 22°22′	Iceland S. S.	10	39	42	B. Sæmundsson, Reykjavik
	— May 24	Da. 8.426	♂	Faxa Bay, 4 miles W by S of Akranes 20 fms.	64°16′ 22°15′	English S. S.	11	27	34.3	Mar. Biol. Assoc., Lowestoft
	— June 2	4468	♂	Faxa Bay, 11 miles WNW of Akranes 20 fms.	64°16′ 22°30′	— —	12	40	43.4	— —
	— Aug. 8	Da. 8.419	♂	7 miles NW by N of Dyra Fjord 27 fms.	66°01′ 24°07′	— —	14	30	32	— —
	— Octbr. 5	Da. 8.417	♂	Faxa Bay, 5 miles NW ¼N of Akranes 34 fms.	64°20′ 22°20′	— —	16	34.5	40.8	— —
Experiment F	1909 July 2	5201	♂	Faxa Bay, 4 miles NW ½W of Grotta 25 fms.	64°10′ 22°07′	Iceland S. S.	1	27		G. Hansen, Reykjavik
1909 June 30	— — —	5234	♀	— — — —	64°10′ 22°07′	— —	1	31	?	— —
35 plaice	— — 6	5214	♂	Faxa Bay off Akranes 21 fms.	64°17′ 22°15′	English S. S.	1	28	28.2	Mar. Biol. Assoc., Lowestoft
No. 5201—5235	— — 14	5235	♂	— — —	64°17′ 22°15′	— —	1	30	29.2	— —
Faxa Bay	— — 16	5216	♂	Found on pontoon. Grimsby		— —	1	30.5	29.3	— —
64°10′ N 22°13′ W	— — 24	5231	♂	— — —		— —	1	29	29	— —
	— — 25	5221	♂	Faxa Bay, 7 miles NW of Grotta 15 fms.	64°11′ 22°16′	— —	1	30.5	31.4	— —
	— — —	5222	♀	— — — —	64°11′ 22°16′	— —	1	31.5	32.2	— —
	— Aug. 5	5232	♀	Found on pontoon. Grimsby		— —	2	30.5	31.1	— —
	— — 6-15	5208	♂	Faxa Bay, 10 miles E of Gardskagi 20 fms.	64°12½′ 22°30′	— —	2	29.5	30.8	— —
	— — —	5212	♀	— — — —	64°12½′ 22°30′	— —	2	32.5	34.6	— —
	— — —	5215	♀	— — — —	64°12½′ 22°30′	— —	2	32	34.1	— —
	— — —	5226	♀	— — — —	64°12½′ 22°30′	— —	2	29	31.1	— —
	— — 7	5224	♀	Faxa Bay off Akranes 20—21 fms.	64°17′ 22°15′	— —	2	31	31	— —
	— — 9	5228	♂	Faxa Bay 17 fms.		— —	2	27		— —
	— — —	5213	♀	— —		— —	2	31		— —
	— — 15	5205	♂	Faxa Bay, 7 miles W by S of Akranes 20 fms.	64°15′ 22°17′	— —	2	29.5	29.5	— —
	— — —	5219	♀	— — — —	64°15′ 22°17′	— —	2	32	30.8	— —
	— — —	5223	♂	— — — —	64°15′ 22°17′	— —	2	30	30.2	— —
	— — 28	5204	♂		64°12′ 21°52′	— —	2	33.5	35.9	— —
	— Sept. 16	5218	♀	Faxa Bay, 8 miles SE by E of Gardskagi c. 23 fms.	64°05′ 22°20′	— —	3	32.5	37.5	— —
	— — 17	5229	♀	Found on pontoon. Grimsby		— —	3	29	32.1	— —
	— Octbr. 26	5202	♂	— — —		— —	4	27	32.7	— —

[1]) »11 Da. inches«.

Particulars of Liberation. Date. Locality. No. of fish, etc.	Particulars of Recovery										
	Date	No. on Label	Sex	Locality reported	Central Position (Approximately)	Fishing Vessel	No. of months between Liberat. and Recovery	Initial Size	Ultimate Size	Sent in by	
					N W			cm	cm		
Experiment G	1909 July 13	5242	♂	Faxa Bay, 1 mile SE of Grotta Light 6 fms.	64°10′ 21°57′	Icel. boat	0	27	28.5	B. Sæmundsson, Reykjavik	
1909 July 5	— — 15	5293	♀	— 23 miles SE ½ S of Stapi 40 fms.	64°39′ 22°47′	English S. S.	0	27.5	26.7	Mar. Biol. Assoc., Lowestoft	
105 plaice	— — 16	5294	♀	— 5 miles NW of Akranes 34 fms.	64°20′ 22°20′	— —	0	30.5		— — —	
No. 5236—5340	— — 20	5250	♀	— off Akranes 21 fms.	63°17′ 22°15′	— —	0	30.5	31.7	— — —	
Faxa Bay	— — 23	5246	♀	— 7 miles NW of Grotta Light 15 fms.	64°11′ 22°16′	— —	0	30	31.0	— — —	
between	— — 23	5273	♀?	— — — —	64°11′ 22°16′	— —	0	33	34.1	— — —	
Engey and Videy	— — 25	5252	♀	— — — —	64°11′ 22°16′	— —	0	34.5	34.7	— — —	
64°11′N 21°51′W	— — 25	5268	♂	— — — —	64°11′ 22°16′	— —	0	29	29.5	— — —	
Depth 14 fms.	— — 25	5318	♂	— — — 18 fms.	64°10′ 22°20′	— —	0	31	31.0	— — —	
	— — 27	5255	♀	— — — 15 fms.	64°11′ 22°16′	— —	0	29.5	30.9	— — —	
	— — 27	5262	♂	— — — —	64°11′ 22°16′	— —	0	32.5	32.5	— — —	
	— — 28	5320	♀	—. 5 miles NW of Grotta Light 30 fms.	c.64°12′22°10′	French S. S.	0	32.5	32.5	Dr. Ad. Cligny, Boulogne	
	— Aug. 4	5291	♂	Found on pontoon. Grimsby		English S. S.	1	25.5	29.5	Mar. Biol. Assoc., Lowestoft	
	— — 6-15	5239	♂	Faxa Bay, 10 miles E of Gardskagi 20 fms.	64°12½′ 22°30′	— —	1	27	28.0	— — —	
	— — —	5259	♂	— — — —	64°12½′ 22°30′	— —	1	31	32.2	— — —	
	— — —	5271	♂	— — — —	64°12½′ 22°30′	— —	1	30	31.1	— — —	
	— — —	5276	♀	— — — —	64°12½′ 22°30′	— —	1	33.5	34.2	— — —	
	— — —	5278	♂	— — — —	64°12½′ 22°30′	— —	1	33.5	35.2	— — —	
	— — —	5281	♀	— — — —	64°12½′ 22°30′	— —	1	29.5	31.0	— — —	
	— — —	5319	♂	— 11½ miles W of Akranes 20 fms.	64°12½′ 22°30′	— —	1	30	30.6	— — —	
	— — —	5329	♀?	— — — —	64°12½′ 22°30′	— —	1	30.5	31.8	— — —	
	— — 10 / — Sept. 13	5338	♂	— 12 miles NW of Akranes c. 30 fms.	64°20′ 22°30′	Dutch S. S.	1	31	32.1	Rijksins. v. h. ond. d. zee., Ymuiden	
	— Aug. 15	5331	♀	— 9½ miles W of Akranes 20 fms.	64°13′ 22°20′	English S. S.	1	30.5	29.3	Mar. Biol. Assoc., Lowestoft	
	— — 21	5261	♂	— 7 miles NW of Grotta Light 13—15 fms.	64°11′ 22°15′	— —	1	32	32.7	— — —	
	— — 23	5303	♂	— 7 miles WNW of Akranes 17 fms.	64°17′c.22°18′	— —	1	29	31.8	— — —	
	— — 24	5260	♂	— 5 miles WNW of Akranes 26 fms.	64°10′ 22°15′	— —	1	33.5	35.2	— — —	
	— — 26	5254	♂	— 7 miles NW of Grotta Light 20 fms.	64°11′ 22°16′	Iceland S. S.	1	32	34	B. Sæmundsson, Reykjavik	
	— — —	5282	♀	— — — —	64°11′ 22°16′	— —	1	30.5	32	— — —	
	— — —	5286	♂	Found on pontoon. Grimsby		English S. S.	1	29.5	30.8	Mar. Biol. Assoc., Lowestoft	
	— — —	5292	♂	Faxa Bay, 5 miles WNW of Akranes 19 fms.	c.64°17′22°15′	— —	1	25		— — —	
	— — 27	5288	♀	— — — —	c.64°17′22°15′	— —	1	30		— — —	
	— — —	5336	♀	— 3 miles E of Grotta Light 17 fms.	64°12′ 21°52′	— —	1	30.5	31.3	— — —	
	— — 28	5257	♂	— — — —	64°12′ 21°52′	— —	1	32	33.8	— — —	
	— — —	5300	♀	— — — —	64°12′ 21°52′	— —	1	28.5	29.3	— — —	
	— — 31	5337	♂	— about 18 fms.		— —	1	30.5	32.0	— — —	
	— Sept. 3	5241	♀	Found on pontoon. Grimsby		— —	2	27.5	28.6	— — —	
	— — 7	5256	♀	Faxa Bay, 8 miles N of Gardskagi 33—34 fms.	64°11′ 22°55′	— —	2	31′	c.30	— — —	
	— — —	5270	♂	— — — —	64°11′ 22°55′	— —	2	31.5	34	— — —	
	— — 12	5253	♂	— 6½ miles NW ½ N of Grotta 14—15 fms.	64°10′ 22°14′	— —	2	29	32.1	— — —	
	— — 13	5267	♂	Found on pontoon. Grimsby		— —	2	30	31.8	— — —	
	— — 14	5287	♂	— —		— —	2	28	30.8	— — —	
	— — 16	5258	♂	Faxa Bay, 8 miles SE by E of Gardskagi c. 23 fms.	64°05′ 22°20′	— —	2	35	38	— — —	
	— — 22	5277	♂	Found in a box of Iceland plaice, London		— —	2	29.5	29.8	— — —	
	— — 29	5311	♂	Found on pontoon. Grimsby		— —	2	29	32.5	— — —	
	— — 30	5317	♀	— —		— —	2	31.5	33.2	— — —	
	— Octbr. 6	5340	♂	— —		— —	3	30.5	33.6	— — —	
	— — 10-20	5264	♀	Iceland		— —	3	35.5		— — —	
	— Nov. 8	5330	♂	Found on pontoon. Grimsby			4	27	32.8	— — —	

Particulars of Liberation. Date. Locality. No. of Fish. etc.	Particulars of Recovery									
	Date	No. on Label	Sex	Locality reported	Central Position (Approximately) N W	Fishing vessel	No. of months between Liberat. and Recovery	Initial Size cm	Ultimate Size cm	Sent in by
Experiment H	1909 July 11	5347	♀	Faxa Bay, 5 miles NNW of Grotta	64°13′ 22°10′	Iceland S. S.	0	29		G. Hansen, Reykjavik
1909 July 9	— — 20	5359	♀	— 5 miles WNW of Akranes 21 fms.	64°17′c.22°15′	English S. S.	0	29.5	29.5	Mar. Biol. Assoc., Lowestoft
60 plaice	— — —	5374	♂	— 7 miles WSW of Akranes 26 fms.	64°14′ 22°13′	— —	0	31	31	— — —
No. 5341—5400	— — 23	5343	♂	— 7 miles NW of Grotta 15 fms.	64°11′ 22°16′	— —	0	29.5	30.3	— — —
Faxa Bay	— — —	5400	♀	— — — —	64°11′ 22°16′	— —	0	30	31.0	— — —
2 miles NE of	— — 25	5348	♂	— — — —	64°11′ 22°16′	— —	0	31.5	32.1	— — —
Grotta	— — 27	5344	♂	— — — —	64°11′ 22°16′	— —	0	28	28.1	— — —
64°12′ N 21°58′ W	— — —	5356	♂	— — — —	64°11′ 22°16′	— —	0	30.5	31.2	— — —
Depth 18 fms.	— — —	5357	♂	— — — —	64°11′ 22°16′	— —	0	29.5	30.7	— — —
	— — —	5369	♂	— — — —	64°11′ 22°16′	— —	0	30.5	31.1	— — —
	— — —	5375	♀	— — — —	64°11′ 22°16′	— —	0	27.5	28.2	— — —
	— — —	5376	♀	— — — —	64°11′ 22°16′	— —	0	31	31.7	— — —
	— — —	5389	♂	— 5 miles WNW of Akranes 21 fms.	64°17′c.22°15′	— —	0	32	33.1	— — —
	— Aug. 6-15	5352	♂	— $11^1/_2$ miles W of Akranes 20 fms.	64°12½′ 22°30′	— —	1	32	33.5	— — —
	— — —	5377	♂	— 10 miles E of Gardskagi 20 fms.	64°12½′ 22°30′	— —	1	27	27.8	— — —
	— — —	5378	♀	— — — —	64°12½′ 22°30′	— —	1	31	31.0	— — —
	— — —	5384	♂	— — — —	64°12½′ 22°30′	— —	1	30	31.1	— — —
	— — —	5387	♀	— 10 miles ENE of Gardskagi 20 fms.	64°12½′ 22°30′	— —	1	28.5	29.6	— — —
	— — 7	5367	♂	— 17 fms.		— —	1	31		— — —
	— — 15	5368	♂	— 7 miles W by S of Akranes 20 fms.	64°12.5′22°20′	— —	1	31	32.1	— — —
	— — 20	5399	♀	Found on pontoon. Grimsby		— —	1	32	32.6	— — —
	— — 21	5351	♀	Faxa Bay, 7 miles NW of Grotta 13—15 fms.	64°11′ 22°15′	— —	1	33	35.2	— — —
	— — —	5360	♂	— — — —	64°11′ 22°15′	— —	1	30.5	32.1	— — —
	— — 24	5390	♀	— 5 miles WNW of Akranes 26 fms.	64°17′ 22°15′	— —	1	31	32.8	— — —
	— — 26	5371	♂	— 7 miles NW of Grotta light 20 fms.	64°11′ 22°16′	Iceland S. S.	1	30	30.5	B. Sæmundsson, Reykjavik
	— — 27	5345	♀	— 5 miles WNW of Akranes 19 fms.	64°17′c.22°15′	English S. S.	1	27.5		Mar. Biol. Assoc., Lowestoft
	— Sept. 3	5385	♀	Found on pontoon. Grimsby		— —	2	28	30.1	— — —
	— — bef. 9	5386	♂	Sent to Liverpool from Hull		— —	2	26.5	26.8	— — —
	— — 12	5353	♀	Faxa Bay, $6^1/_2$ m. NW$^1/_2$W of Grotta 14-15 fms.	64°10′ 22°14′	— —	2	33	34.2	— — —
	— — 13	5362	♂	Found on pontoon. Grimsby		— —	2	30	30.8	— — —
	— — —	5393	♂	— —		— —	2	30.5	33.8	— — —
	— — —	5394	♀	— —		— —	2	30	32.5	— — —
	— — 15	5396	♂	Faxa Bay, c. 5 miles W of Akranes 30 fms.	64°15′ 22°14′	— —	2	29.5		— — —
	— — 17	5398	♀	Found on the market at Grimsby		— —	2	29	31.7	— — —
	— — 24	5381	♀	Found on pontoon. Grimsby		— —	2	30.5	32.7	— — —
	— Octbr. 6	5388	♂	— —		— —	3	30.5	33.4	— — —
	— — 9	5365	♂	Faxa Bay, 7 miles NW of Grotta Light 34 fms.	64°10′ 22°15′	Iceland S. S.	3	30	33.5	B. Sæmundsson, Reykjavik

2. Experiments on the northwest coast

These experiments were carried out on board the »Thor« under supervision of Dr. SCHMIDT but, they were not so extentive as those in the Faxa Bay, as only 73 plaice were marked. They were all trawled in shallow water and rather small-sized, the length being 25—33 cm. The experiments were accomplished in two divisions: 24 specimens were caught in the Patricks Fjord on July 14th, 1908 and liberated off Bardinn, on 66° 04′ N, 23° 49′ W; 49 were caugth and liberated on July 19th on 65° 45′ N, 24° 15′ W, off the mouth of Patricks Fjord. Further details about these experiments will be seen on the lists I and J.

Particulars of Liberation. Date. Locality. No. of fish. etc.	Particulars of Recovery										
	Date	No. on Label	Sex	Locality reported	Central Position (Approximateley)	Fishing Vessel	No. of month between Liberat. and Recovery	Initial Size	Ultimate Size	Sent in by	
Experiment I					N W			cm	cm		
1908 July 14	1909 April 20	Da. 8.436	♀	Faxa Bay, $6^1/_2$ miles WNW of Akranes	c.64°17′22°18′	English S. S.	9	25.5	27	Mar. Biol. Assoc., Lowestoft	
24 plaice	— June 22	Da. 8.453	♀?	N. W. Icel. 1 miles NW of Flateyri 12 fms.	66°04′ 23°32′	Danish boat	11	25	27	Danish fisherman	
No. Da. 8. 433— Da. 8. 456	— August 10	Da. 8.440	♀	— off Dyra Fjord, 10 miles 32 fms.	66°01′ 24°09′	English S. S.	13	33	36	Mar. Biol. Assoc., Lowestoft	
Bardinn 66°04′ N 23°49′ W	— Decbr. 18	Da. 8.456	♀	— 12 miles NW by W of Bardinn 41 fms.	66°05′ 24°15′	— —	17	25	34.6	— — —	
Depth 13 fms.	1910 — c. 14	Da. 8.433	♂	Iceland		— —	29	29.5	39.6	Intern. Fish Investig., Hull	
Experiment J	1908 Septb. 9	Da. 8.479	♀	Sent to Manchester from Hull		English S. S.	2	30	31.1	Mar. Biol. Assoc., Lowestoft	
1908 July 19	— —	Da. 8.489	♂	4—5 miles off Arnar Fjord c. 30 fms.	65°55′ c.24°10′	— —	2	27.5	?	— — —	
49 plaice	1909 March 15	Da. 8.490	♂	Sent to Chesterfield from Hull		— —	8	27		— — —	
No. Da. 8. 457—	— April 1	Da. 8.466	♂	Isafjord Deep, Hnifsdalsvik	66°08′ 23°05′	Icel. fisher	9	27.5	30.5	B. Sæmundsson, Reykjavik	
Da. 8. 505	— June 16	Da. 8.500	♂	5.5 miles NE of Kopanes 25 fms.	65°54′ 24°02′	English S. S.	11	27	31.6	Mar. Biol. Assoc., Lowestoft	
The mouth of Patricksfjord	— Aug. 8	Da. 8.491	♀	7 miles NW by N of Dyra Fjord 27 fms.	66°01′ 24°07′	— —	13	27	32.0	— — —	
	— Sept. 2	Da. 8.477	♂	Faxa Bay, $6^1/_2$ miles WNW of Akranes 20 fms.	64°17′ 22°18′	— —	14	30.5	?	— — —	
65°45′ N 24°15′ W	— Octbr. 29	Da. 8.478	♂	12 miles NW $^1/_2$ N of Bardinn 36 fms.	66°05′ 24°15′	— —	15	28	30.3	— — —	
Depth 18 fms.	1910 Jan. 15	Da. 8.476	♂	W. Iceland, 16 miles NW $^1/_4$ W of Bardinn 50 fms.	66°07′ 24°25′	— —	18	29.5	34.0	— — —	
	— Aug. c. 20	Da. 8.484	♂	Found in a box on market. Grimsby			25	29	38.1	— — —	
	— Dec. c. 10	Da. 8.503	♂	Iceland		English S. S.	29	25	34.7	Intern. Fish. Investig., Hull	

From the particulars given in the lists above several conclusions can be drawn.

Rate of growth

Notwithstanding the above mentioned measures taken to prevent a simultaneous recapture of the fish marked in the Faxa Bay, a great majority of them, or 78 % of the recaptured fish, were retaken during the three first months after liberation, as the fish have evidently sought the localities where they had lived before marking, i. e. their feeding grounds, immediately after liberation. The following summary will show the relation between the number of months elapsed from liberation (the period of growth) and the number of fish recaptured in each month, all concerning the Faxa Bay.

No. of months	0	1	2	3	4	8	9	10	11	12	13	14	16	17	18	20	21	22	23	24	25	27
No. of fish retaken . . .	50	56	47	25	3	1	6	9	9	3	1	3	1	1	2	2	2	1	5	1	1	2

Adding to this the fact that the measurement of the retaken fish is in several cases somewhat inaccurate, it will easily be seen that the fish which have stayed less than one month in the sea after liberation cannot form any reliable base for the discussion of the growth and must therefore be left out of consideration. All the remaining specimens were recovered within 27 months after liberation, and concerning them I will draw up a summary like those above, but in many cases communications about the ultimate size are wanting.

Plaice marking experiments A—H

732 plaice marked June 16th to 30th June 1908 and June 30th to July 9th 1909 in the Faxa Bay in Southwest Iceland.

Year and Month of recapture	Period of growth (months)	No. of specimens	Average growth in cm	Least growth in cm	Greatest growth in cm	Recaptured
1908, July, August	1	50	1.50	0.0	4.5	Faxa Bay
— August	2	36	1.6	0.0	3.7	— —
— September	3	21	3.22	0.5	5.5	— —
— September, October	4	3	5.07	2.7	6.3	— —
1909, March	9	4	2.45	0.7	3.1	S- and NW-Iceland
— April	10	9	3.11	1.8	4.2	SW-Iceland
— May	11	7	5.17	2.7	8.0	—
— June, July	12	3	3.87	3.8	3.9	Faxa Bay
— July	13	1	8.00	8.0	8.0	— —
— August	14	2	2.85	2.5	3.2	NW-Iceland
— October	16	1	6.8	6.8	6.8	Faxa Bay
— December	18	2	4.0	2.0	6.0	NW-Iceland
1910, March	21	2	2.65	2.6	2.7	Faxa Bay
— May	23	5	4.84	3.3	8.0	— —
— June	24	1	15.5	15.5	15.5	— —
— July	25	1	13.0	13.0	13.0	W-Iceland
— August	26	1	4.0	4.0	4.0	Faxa Bay
— September	27	1	9.1	9.1	9.1	— —

This summary illustrates the growth of plaice marked and liberated and, for the greater part, retaken in the Faxa Bay, or at least off the southwest coast of Iceland, ɔ: in the warmer water, month by month, and as regards some of the specimens until somewhat more than two years after liberation. Unfortunately in many cases the material is insufficient, as the number of retaken and measured individuals is only 1—3. Besides this the growth is often somewhat irregular and far from being proportional to the time spent in the sea; thus for instance specimens which have stayed 21 month in the sea after liberation have only grown 2.6—2.7 cm., while others have increased 2.7—8.0 cm. (in average 5.17 cm) in length during 11 months. Similar irregularities in the growth of the plaice in the Kattegat are indicated by Dr. A. C. Johansen[1]), but in many cases these irregularities would doubtless have been compensated, if the number of individuals retaken in every month had been more equal. Though on the whole these experiments must be considered as giving a fairly good idea of the rate of growth of medium-sized plaice in the warmer waters at Iceland[2]), yet the average annual growth is not easy to determine. I should think it is something like 6 cm., or over double the rate of growth of the plaice in the colder waters of the east coast of Iceland, and almost the same as the lowest rate of growth found by Dr. Johansen in the eastern part of the North Sea (the Horn Reef)[3]). Yet it must be remembered that some of the fish in question were considerably smaller when marked than those on the east coast, and that circumstance might in some cases have influenced the growth. I have been unable to discover any difference in the rate of growth of the sexes.

[1]) Contributions to the biology of the plaice etc. II. Meddel. fra Komm. for Havundersøgelser, Serie Fiskeri, Bd. II., Nr. 7, 1907, p. 66 etc.

[2]) Nothing has hitherto been published about the age of the Icelandic plaice, and therefore nothing certain can be sai about the probable age of the above recorded fish. I have examined some 30 – 40 cm. long fish from the Faxa Bay and foun the age to be 4 – 8 years.

[3]) Schmidt, op. cit., p. 9.

Plaice marking experiments I—J

73 plaice marked July 14th and 19th of the northwest coast of Iceland.

Year and month of recapture	Period of growth (months)	No. of Specimens	Average growth in cm	Least growth in cm	Greatest growth in cm	Recaptured
1908, September	2	1	1.6	1.6	1.6	?
1909, April	9	2	2.5	2.0	3.0	NW and SW Iceland
— June	11	2	3.8	2.5	5.1	NW Iceland
— August	13	2	4.4	3.3	5.5	— —
— October	15	1	2.8	2.8	2.8	— —
— December	17	1	10.1	10.1	10.1	— —
1910, January	18	1	5.0	5.0	5.0	— —
— August	25	1	9.6	9.6	9.6	?
— December	29	2	10.4	10.2	10.6	?

From this table it will be seen that the rapidity of increase also here is very different as regards the single individuals. The scarcity of material does not permit any accurate judgment of the average growth, but it seems to be about the same as that of the plaice marked in the Faxa Bay. The hydrographical conditions of the northwest coast also resemble more those of the water along the southwest coast, than of the northeast coast, as a branch of the Gulf Stream, the Irminger Current, which washes the southwest coast, runs alongside the west coast, and then, turning round the Northwest-peninsula, flows eastwards along the north coast[1]).

Migrations

I mentioned above, recording the experiments in the Faxa Bay (A—H) that a great majority (78 %) of the retaken plaice had been captured during the three first months after liberation, and all these fish were, as far as particulars are given about the locality of recapture, caught within the limits of the bay. As to the remaining 22 % of the fish, the majority again were taken within the same limit. Of the 732 plaice liberated in the Faxa Bay 232 have been recaptured till now, but the locality of recapture has only been communicated for 169 of them. Of these 169 plaice again only 11 have been recovered beyond the limits of the bay. From these figures and from the charts, it will already be very clearly seen, that by far the greatest part, or 95 % of the plaice marked in the Faxa Bay, have not left the bay at all, notwithstanding the relatively long time, up to 27 months, which in many cases has elapsed between liberation and recovery, or in other words: most of the fish or 95 % have been stationary in the bay; though I must emphasise that many of the individuals which were retaken near the place, where they were liberated, during the first 2—3 months after liberation, would probably have wandered more or less far from that place if they had stayed longer in the sea.

The 11 specimens of plaice which had left the bay were all retaken at a considerable distance from the bay. They have very distinctly divided themselves in two groups, one, consisting of 6 individuals, had migrated southwards, where the single specimens were recaptured on the banks south and west of the Westman Isles. The other group, 5 specimens, had wandered in the opposite direction, i. e. northwards, to the banks off the northern part of the west coast (the northwest coast), where they were recaptured on the stretch between Bjargtangar (Fuglebjærg Huk) and Isafjord Deep. These far (southwards and northwards) migrating individuals were by no means those, which had stayed the longest time in the sea, with one or two exceptions they had only spent 9—11 months in the sea. Another fact

[1]) J. N. Nielsen, Contributions to the Hydrography of the Waters North of Iceland. Meddel. fra Komm. for Havundersøgelser, Serie Hydrografi, Bd. I, Nr. 7, 1905.

—·—·— *40 Meter.*

Fig. 3. Marking and Transplantation Experiments on plaice.
Faxa Bay. June 1908. July 1909. Experim. A & H. (see text p. 24).

of interest is the circumstance that no plaice at all are taken on the wide space to each side between the uttermost localities, where they were recaptured in the Faxa Bay, and the remote places where they were recovered outside the bay, although there are extensive trawling grounds between (see Fig. 3—6).

A glance at the charts (Fig. 3—6) will give a very clear idea of the movements of the plaice marked in the Faxa Bay. In this respect two different things are remarkable: During the experiments B, C. D,

—·····—····· *100 Meter.* _____ *200 Meter.*

Fig. 4. Marking and Transplantation Experiments on plaice.
Faxa Bay. June 1908. Experim. B & D.

E, G and H, the marked plaice were as a rule caught on the banks far from the coast, but were carried (transplanted) towards the coast and liberated there. In all the cases the fish have with a few exceptions, taken their way with greater or less rapidity off to the open bay, ɔ: to their feeding grounds, or to more remote parts of the bay (Exp. C.), or (as recorded formerly) to more distant parts of the south and west coast (Exp. B, D, E). During the experiments A and F again the fish were marked and set out in the open bay, on the banks, where the fish are accustomed to feed, and where the great fishery is carried on. In these cases the fish have moved in all directions, though in the first case (A) with preva-

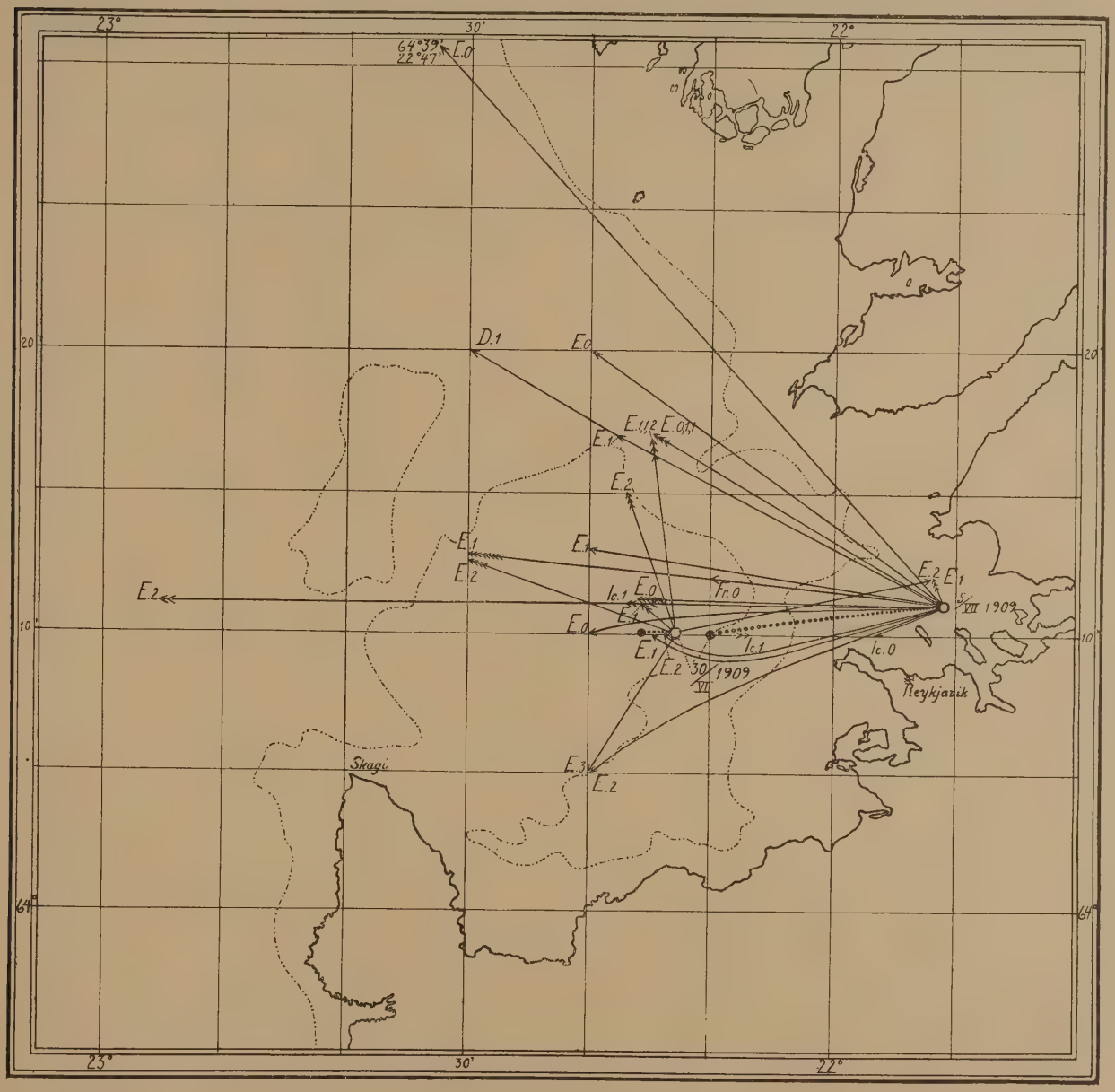
.... 100 Meter. _____ 200 Meter.

Fig. 5. Marking and Transplantation Experiments on plaice.
Faxa Bay, June 1908. Experim. C & E.

lent tendency to seek the open sea. From all these experiments it will be seen, that a great majority of the plaice, marked in the Faxa Bay and recovered, have been stationary in the bay, in many cases for a considerable time. Only very few have left the bay and sought more distant grounds, equally to south and north, yet without passing the limits of the warmer water on the south and the west coast; on one side they have reached the Westman Islands, on the other the Isafjord Deep.

The experiments on the northwest coast (I. J) only dealt with 73 plaice. Of these, 17 have hitherto been recovered, but the locality of recovery has only been communicated for 12 of them. In this case all, with one exception, have remained a considerable time (9—12 months) in the sea after liberation, and thus therefore, although few in number, yield fairly good material for the study of the migrations.

Chart (Fig. 1) illustrates this. A glance at this chart shows clearly that the majority of the fish marked have been stationary on the northwest coast; the fish from Exp. I have moved slightly southwards, the fish from Exp. J. northwards, and mixed together on the banks off Arnar Fjord and Dyra Fjord, where they were retaken. None of the fish from Exp. I seem to have sought the locality (Patricks Fjord) where caught.



—·—·—·— *40 Meter.*

Fig. 6. Marking and Transplantation Experiments on plaice.
Faxa Bay, June—July 1909. Experim. F & G.

Three only have made longer migrations, one from Exp. J has wandered to the Isafjord Deep, whilst two (one from each experiment) have reached the southern part of the Faxa Bay. Thus these experiments show the same features as those in the Faxa Bay: The majority of the plaice marked on the northwest coast and recovered have been stationary for a long time (9—29 months) on the

coast where marked; only two specimens have migrated to remote grounds, but not beyond the limits of the warmer water of the west coast.

I recorded above that most of the plaice marked, both in the Faxa Bay and off the northwest coast, had been stationary in the vicinity of the localities where liberated. Few individuals only proved to be migratory and had wandered partly southwards, partly in the opposite direction. The minimum distances they covered varied considerably. The individuals from the Faxa Bay which wandered southwards have reached the Westman Isles, which means 60—70 miles, whilst those which wandered northwards and reached the banks off Ønundar Fjord have migrated 160—170 miles at least. The specimens again which were set out off the northwest coast and recovered in the Faxa Bay off Akranes must at least have migrated 120—140 miles.

The rate of speed at which the plaice in question have migrated, has of course varied greatly, supposing that they have taken the shortest way between the locality of liberation and that of recovery, which in most instances has scarcely been the case; about their true route we really know nothing. Some examples concerning the farther migrating specimens will illustrate the fact:

Experiments[1])	Locality of liberation	Locality of recovery	Time in days	Distance covered in miles	Average speed pr. day in miles
Exp. D	Vatnsleysuvik, Faxa Bay	10 miles off Skálavik, NW-Iceland	273	165	0.6
— I	Off Bardinn, NW Iceland	Off Akranes, Faxa Bay	281	145	0.5
— E	Off Mariuhöfn, Faxa Bay	9 miles off Dyra Fjord, NW-Iceland	407	165	0.4
— J	Off Patricks Fjord, NW Iceland	Off Akranes, Faxa Bay	410	120	0.3
— B	Off Keflavik, Faxa Bay	12 miles off Dyra Fjord, NW-Iceland	259	150	0.27
— D	Vatnsleysuvik, Faxa Bay	12 miles SW of Westman Iceland	299	60	0.2

From this table it will be seen that the average speed is rather low, somewhat like that of the plaice from the Vopna Fjord experiments (cf. p. 5), but as the way is supposed to be the shortest possible, the rate of speed in most cases is very probably much higher. The highest rate of speed is obtained by an individual from the Experiment G. (No. 5293), which had covered 38 miles in 10 days, or 3.8 miles pr. day. It must be taken for granted, that the plaice considered having been stationary during some months in the vicinity of the localities where liberated, must have moved very slowly.

When the plaice marking experiments of 1908 and 1909 in the warmer water on the west coast are compared with the corresponding experiments in the colder water on the north and east coast 1903 and 1905, the difference between them is evident: the plaice marked in the colder water wandered for the most part away from this and sought the warmer water on the south or west coast, while the fish marked in the warmer water have been stationary, and the few individuals that migrated to more distant places have not left the warmer water of the south and the west coast. The plaice marked in the warm water have in many cases behaved like the plaice marked by Dr. A. C. Johansen[2]) in the waters round Denmark (the North Sea, the Skager Rak and the Kattegat). The resemblance in migrations will easily be seen by comparison of the charts accompanying this paper with the charts and text-diagrams in the cited papers of Johansen.

Intensity of the plaice fishery etc.

I mentioned above that of the 805 plaice marked and set out in 1908—1909 only 279 or 30.93 % had been recaptured (ɔ: so many marks hitherto delivered). Yet there is a great difference in the inten-

[1]) Cf. the list of Marking stations, p. 14—19.

[2]) Contributions to the biology of the plaice etc. I—II. Medd. fra Komm. for Havundersøgelser, Serie Fiskeri. Bd. I, Nr. 2, 1905 and Bd. II, Nr. 7, 1907.

sity of recapture according to the locality where the fish were liberated; in some cases up to two thirds of the liberated fish have been retaken, in others only some few. The following summary will give the best idea of the matter.

Plaice marking experiments on the west coast in June and July 1908—1909

Experiments	Locality of liberation	Date of liberation	Number of plaice		Intensity of fishery per cent
			liberated	retaken	
Exp. A	Faxa Bay, 6 miles SW of Akranes	1908, June 16—19	96	54	56.25
— B	— off Keflavik	— — 22—23	100	12	12.0
— C	— Hval Fjord, off Mariuhöfn	— — 23	81	2	2.46
— D	— Vatnsleysuvik	— — 25—26	136	30	22.05
— E	— Hval Fjord, off Mariuhöfn	— — 27	119	26	21.85
— F	— 11 miles NW of Grotta Light	1909 — 30	35	23	65.71
— G	— between Engey and Videy	— July 5	105	48	45.71
— H	— 2 miles NE of Grotta Light	— — 9	60	37	61.66
— I	NW-coast, off Bardinn	1908, — 14	24	5	20.83
— J	— off Patricks Fjord	— — 19	49	11	22.4

From this table it will easily be seen, that the percentage of recapture is highest, as regards the Faxa Bay, for the fish liberated nearest to the most frequented trawlfishing grounds of the southern part of the Faxa Bay, the Svidid and other tracts round the Sydra Hraun (see above); here the percentage amounts 56.25 to 65.71, or one half to two third of the plaice liberated, and the majority of these fish are taken during the 3—4 next months after the liberation. For the more remote localities the percentage is much lower, 12—22, and in one case (Exp. C) it goes down to 2.46. Concerning the experiments on the north west coast, which were carried out in the vicinity of considerably frequented trawlfishing grounds off the Dyra Fjord, they show a comparatively low rate of recapture, 20.83—22.4 %. On the whole these experiments show relatively great intensity of plaice fishery in these waters, as the average percentage is, as recorded above 30.93, and in the cases, where the fish have been liberated on, or in the vicinity of highly frequented trawl-fishing grounds in the Faxa Bay, very great. Here the conditions very much resemble those in the North Sea and other waters round Denmark, where, according to JOHANSEN, 30—54 % of the marked plaice have been retaken in the first year after liberation. On the other hand, they are quite different from the conditions on the north and east coast of Iceland, where the intensity of fishery only rises to 5—6 %.

If we want to know the proportion between the quantity of marked plaice in question caught by fishermen belonging to the different nations fishing in the waters round Iceland, we only need to take a hasty glance at the lists (A—J) above, in order to see that the lion's share is taken by English fishermen (steamtrawlers), some few by Icelanders (steam trawlers and open boats) and very few by other nations. On closer examination we find the proportion to be as follows:

Recapture of plaice marked in the Faxa Bay and on the northwest coast 1908—1909 (A—J)

	English	Icelandic	Dutch	French	Danish	Uncertain	Total
No of fish retaken	216	24	2	2	1	3	248
Percentage	87.1	9.67	0.81	0.81	0.40	1.21	100

These figures show very clearly the predominating position occupied by the British fishermen regarding the plaice fishery in Iceland waters, especially in the Faxa Bay. Of the 24 specimens taken by

[1]) Om Rødspætten og Rødspættefiskeriet i Beltfarvandet, Skrifter udgivne af Komm. for Havundersøgelser No. 7, 1912; p. 96—97.

Icelandic fishermen 15 are caught by steam trawlers, the remainder by open boats. This agrees well with the relatively rapid developement of the Icelandic trawlfishing in the last decade.

B. Marking experiments on cod *(Gadus callarias)*

I have shortly recorded above, that marking experiments were made on cod in the years 1908 and 1909 together with the experiments on the plaice, but they were carried out on a much smaller scale, as only 227 specimens were liberated. The bulk of the fish marked, or 200 specimens, were marked and liberated in the Faxa Bay at the end of June 1909 by Capt. G. Hansen, whilst the remaining 27 specimens were marked and set out by Dr. Schmidt on board the »Thor« in the Skjalfandi Bay on the North coast on July 24th 1908. Thus also these experiments fall into two divisions: the experiments in the Skjalfandi Bay and the experiments in the Faxa Bay.

1. Experiments in the Skjalfandi Bay

These experiments were accomplished, as mentioned above, on July 24th, and comprised 27 specimens of young, immature cod, trawled at 17—37 m depth near the head of the bay, and liberated on the same place, as seen from the following list:

Particulars of Liberation. Date. Locality. No. of fish. etc.	Particulars of Recovery								
	Date	No. on Label	Locality reported	Central Position (Approximately	Fishing Vessel	No. of month between Liberat. and Recovery	Initial Size	Ultimate Size	Sent in by
				N/ W			cm	cm	
Experiment A 1908 July 24 27 cod No. Da. 08.506—Da. 08.532 Skjalfandi Bay 66°01′ N 17°30′ W Depth 10—19 fms.	1909 Aug. 31	Da. 8.528	Skjalfandi Bay, c. 20 fms.	?	Icel. op. boat	13	54	(68) [1]	Bjarni Sæmundsson

From these particulars it will be seen that till now only one single specimen (3.7 %) has heen recovered, quite near the locality where it was set out. It seems to have been stationary on the north coast (may be in the bay itself) all the time (13 months) it had spent in the sea after liberation, and had grown 14 cm in this time. Thus this single specimen agrees fairly well, as regards the growth, with those recovered from the other experiments on the north and east coast (cf. Schmidt, op. cit., p. 17, and my remarks above concerning the experiments in the Skaga Fjord).

2. Experiments in the Faxa Bay

These experiments, which comprised 200 young, immature cod, trawled and liberated in shallow water, were carried out in the southern part of the Faxa Bay, as communicated in following table.

Experiment	Date	Locality of capture	Locality of liberation
Exp. B	1909, June 27	64°16′ N 22°33′ W	64°16′ N 22°33′ W, 12 miles WNW of Akranes
— C	— — 29	64°08′ N 22°30′ W	64°08′ N 22°30′ W, 5 miles E of Gardskagi
— D	— — 30 and July 1	63°10′ N 22°16′ W	64°10′ N 22°16′ W, 7 miles NW of Grotta Light

Although all the localities of liberation are lying on the most frequented trawlfishing grounds of the bay, hitherto only 30 specimens of the 200 marked have been recovered. The particulars of the re-

[1]) 26 Da. inches.

Particulars of Liberation. Date. Locality. No. of fish. etc.	Particulars of Recovery									
	Date	No. on Label	Sex	Locality reported	Central Position (Approximately)	Fishing Vessel	No. of month between Liberat. and Recovery	Initial Size	Ultimate Size	Sent in by
					N W			cm	cm	
Experiment B	1909 Aug. 26	5009	♂	Found on pontoon. Grimsby		English S. S.	2	62	64.2	Mar. Biol. Ass., Lowestoft
1909 June 27	— Sept. 10	5007	♀	— —		— —	3	41	42	— — —
34 cod										
No. 5001—5034										
Faxa Bay	1910 May 13	5002		Faxa Bay, 7 miles WNW of Grotta Light 20 fms.	64°13′ 22°14′	Iceland S. S.	11	46	62.6	B. Sæmundss., Reykjavik
12 miles WNW of Akranes	— June 9	5024		Isafjord Deep, NW of Vigur, c. 80 fms.	66°07′ 22°52′	Icel. op. boat	12	52	65.7	— —
64°16′N 22°33′W										
Depth 23 fms.										
Experiment C	1909 June 30	5076		Faxa Bay, 5 m. E of Gardskagi 18 fms.	64°08′ 22°30′	Iceland S. S.	0	47	47	B. Sæmundss., Reykjavik
1909 June 29	— ab. Jul. 15	5055		Faxa Bay		English S. S.	1	46	?	Mar. Biol. Ass., Lowestoft
54 cod	— Aug. 3	5077		Found on pontoon. Grimsby		—	2	48	49.2	— — —
No. 5035—5088	— — 6—15	5083		Faxa Bay, 10 m. E of Gardskagi 20 fms.	64°12½′ 22°30′	— —	2	42	43.8	— — —
Faxa Bay	— Sept. 9	5042		— 8 miles W of Grotta 20 fms.	64°06′ 22°16′	Iceland S. S.	3	40	45	B. Sæmundss., Reykjavik
5 miles E of Skagi	1910 May 16	5040		— 4 miles N of Grotta Light c. 25 fms.	c.64°10½′22°08′	— —	11	55	73.2	— — —
64°08′N 22°30′W	— Aug. 4	5057		— 4 m. N of Grotta Light 20 fms.	64°13′ 22°05′	English S. S.[1])	14	54	75	Mar. Biol. Ass., Lowestoft
Depth 18 fms.	— — 24	5070		— — —	64°13′ 22°05′	— —	14	47	66.5	— — —
Experiment D_1	1909 July 5	5108		Faxa Bay, off Akranes 21 fms.	64°17′ 22°15′	English S. S.	0	66	65.3?	Mar. Biol. Ass., Lowestoft
1909 June 30	— — 20	5098		— 8 m. W of Reykjavik 22 fms.	64°08′c.22°17′	Iceland S. S.	0	50	51	B. Sæmundss., Reykjavik
25 cod	— Aug. 8	5102		— 8 miles E by N of Gardskagi 18 fms.	64°11′ 22°30′	English S. S.	1	44	44	Mar. Biol. Ass., Lowestoft
No. 5089—5113										
Faxa Bay	— Sept. 17	5104		— 5 miles NNE of Gardskagi 25 fms.	64°10′c.22°40′	Iceland S. S.	2	48	54	B. Sæmundss., Reykjavik
7 miles NW of Grotta	— June 15	5091		— 9 miles WNW of Gardskagi 52 fms.	c.64°03′22°59′	Icel. op. boat	11	45	67.9	— — —
64°10′N 22°16′W										
Depth 15 fms.	— — 23	5113		— 14—25 fms.	64°15′ 22°20′	English S. S.	12	51	63	Mar. Biol. Ass., Lowestoft
Experiment D_2	1909 July 2	5125		Faxa Bay, 7 miles NW of Grotta 15 fms.	64°10′ 22°16′	Iceland S. S.	0	60	60	G. Hansen, Reykjavik
1909 July 1	— — —	5126		— — —	64°10′ 22°16′	— —	0	51	51	— —
87 cod	— — —	5167		— — —	64°10′ 22°16′	— —	0	41		— —
No. 5114—5200	— — —	5170		— — —	64°10′ 22°16′	— —	0	57		— —
Faxa Bay	— Aug. 8	5142		— 8 miles E by N of Gardskagi 18 fms.	64°11′ 22°30′	English S. S.	1	53	51.3	Mar. Biol. Ass., Lowestoft
7 miles NW of Grotta	— — —	5197		— — —	64°11′ 22°30′	— —	1	42	41.7	— — —
64°10′N 22°16′W	— — 15	5193		— 7 miles W of Akranes 20 fms.	64°14′ 22°15′	— —	1	58	57.2	— — —
Depth 15 fms.	— — bef. 19	5189		— off Akranes 25 fms.	c.64°17′c.22°15′	— —	1	45	45.0	— — —
	— Sept. 3	5191		— Found on pontoon, Grimsby		— —	2	48	51.2	— — —
	— — 8	5174		— 6 m. E of Gardskagi 17 fms.	64°10′ 22°35′	— —	2	48	?	— — —
	1910 May 26	5165		— 7 miles NNW of Grotta Light c. 20 fms.	64°13′ 22°15′	Iceland S. T.	10	45	61	B. Sæmundss., Reykjavik
	— July 24	5116		— 2 miles ENE of Gardskagi 25 fms.	c.64°07′22°36′	Icel. op. boat	13	40	36.5?	— —

coveries will be seen in the lists above (B, C, D_1, D_2) and on the charts (Fig. 2 and 7). These particulars show several facts of interest, which give cause for some conclusions.

Rate of growth

Before discussing this matter, it must be recorded, that reliable communications about the ultimate size are only given concerning 25 of the 30 cod recovered. As to the remaining 5, the communications are lacking or evidently erroneous, wherefore they are of no value in this respect. Beside this, 3 specimens were retaken the day after liberation, and must thus be left out of consideration. The details regarding the growth of the other 22 will be seen from the following summary.

[1]) indicated in Fig. 7 as »? 14«, particulars failing at the drawing of the charts.

Cod marking experiments B—D

200 cod marked June 27th to July 1st 1909 in the Faxa Bay in Southwest Iceland.

Year and month of recapture	Period of growth (months)	No. of specimens	Average growth in cm.	Least growth in cm.	Greatest growth in cm.	Recaptured
1909, July	0	1	1.5	1.5	1.5	Faxa Bay
— August.	1	9	0.88	0.0	2.7	Faxa Bay
— September	2	4	4.05	1.5	6.5	Faxa Bay
1910, May	10	2	17.9	17.1	18.7	Faxa Bax
— May June.	11	3	18.03	14.2	23.4	Faxa Bay
— June	12	1	12.5	12.5	12.5	Faxa Bay
— July	13	1	21.5	21.5	21.5	Faxa Bay
— August.	14	1	20.0	20.0	20.0	Faxa Bay

The 22 specimens recorded may be regarded as a somewat scanty material for judging the rate of growth of the cod marked in the Faxa Bay; and when to this is added the circumstance, that the majority of this material consists of individuals which (like the plaice) were recovered during the two first months after liberation, as a consequence of being liberated in the middle of the fishing season on highly frequented grounds, it is evident that it can only be used with great caution; yet the few individuals which have stayed 10—14 months in the sea after liberation show the very interesting fact, that the rate of growth is much higher here than in the colder water on the east and north coast, being about 18 cm in the year. And this cannot be considered as a mere accident, as the specimens, although few, agree fairly well with each other.

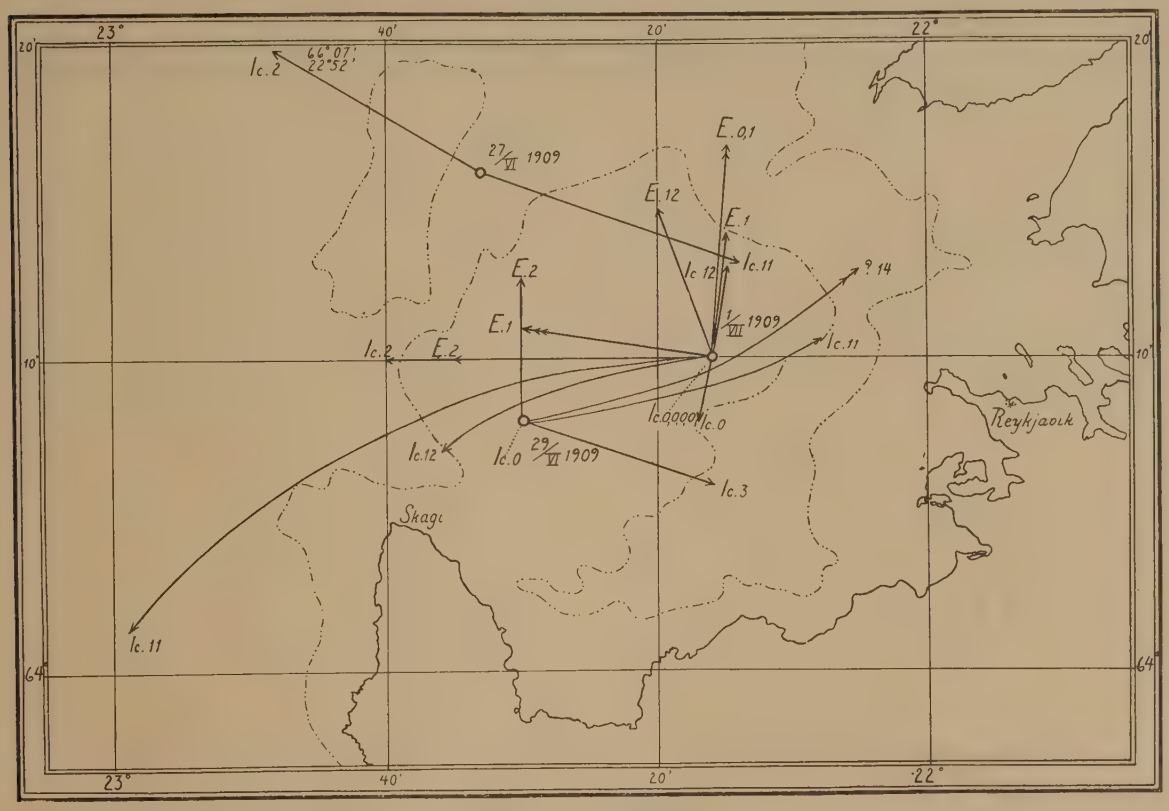
The cod marked was a medium sized, immature fish, 40—66 cm long, probably belonging to the age-group II and III. A glance at the lists B—D_2 will show that the growth of the biggest individuals, which have been allowed to stay in the sea for a longer time, has been as rapid as that of the smallest ones, and from that fact it is permissible to suppose that the growing period (i. e. the period from hatching to the commencement of maturity) of the cod on the south and southwest coast of Iceland must be relatively short, not much longer than in more southern waters. I have previously stated[1]) that the cod on the south coast of Iceland attains sexual maturity when c. 60 cm long for the male, c. 70 cm long in the case of the female but, at what age this occurs cannot be said at present; though I should think it would take place in the fifth or sixth year.

Migrations

As regards the migrations of the cod marked and liberated in the Faxa Bay 1908, it will be seen from the Lists B—D_2, that communications about the locality of recapture are wanting for 5 of the 30 specimens recovered. The migrations of the remaining 25 are laid down on the chart (Fig. 7). By a glance at these it will easily be seen that all the specimens save one, have been taken in the bay, in the vicinity of the localities of liberation, and very likely they never have left the bay in the meantime, or perhaps sought the adjacent deeper water during the winter; in other words: they have been stationary in the bay or the adjacent deeper water. Here we meet with another biological feature evidently different from what the experiments on cod on the east and the north coast brought to light. There many of the individuals were migratory before reaching adult age, here again, on the southwest coast, the most of them are stationary. It is a fact well known to the native fishermen, that there are great quantities of cod on the southwest coast, which I have some reason for supposing are hatched and grow up there,

[1]) Oversigt over Islands Fiske. Skrifter udgivne af Komm. for Havundersøgelser Nr. 5 1908, p. 44. Fiskirannsóknir 1905, Andvari 1906, p. 115.

without ever leaving that tract until they become adult. How far they later undertake any greater migrations, is an other question, and a problem which demands new marking experiments to sufficiently solve[1]).



..._..._ 40 Meter.

Fig. 7. Marking experiment on cod.
Faxa Bay, June and July 1909. Experim. B, C & D.

On closer examination of the chart (Fig. 7) it will be seen that the specimens recovered have moved in various directions. In the case of the experiment C they have moved inwards nearer to land, but very slowly, the farthest going specimens having only covered some 12 miles during 13 months or 400 days, which means at least an average speed of 0.03 miles pr. day. With the experiment D many of the specimens have moved at the same rate of speed towards open sea. Only one has reached the outer limit of the bay, and thus covered a distance of some 20 miles but very slowly ɔ: in 340 days, or 0.06 miles pr. day. Finally one of the specimens from Experiment B has made an exception, as it has left the bay and was retaken in the Isafjord Deep, having migrated at least a distance of 176 miles in 352 days, or 0.5 miles pr. day.

Intensity of cod fishery etc.

I recorded above that only 30 specimens or 15 % of the 200 cod marked and liberated in the Faxa Bay had been recovered (marks delivered) up to the present. Provided that the plurality of the marks from the recaptured fish have been delivered, this cannot be regarded as very intense fishery, especially when it is remembered that the fish, as above remarked, were liberated just in the middle of the fishing

[1]) In connexion with this I will mention a fact, which is well known in later years, viz. that great shoals of, for the greatest part, rather small-sized, 60—80 cm long, cod annually collect in the months of November—January on the trawling banks off the Isafjord Deep and farther eastward. These are, I suppose, fish, which are retiring from the north coast as the water there becomes colder, a great majority grown up fish which are preparing to spawn for the first time but a part also older fishes.

season, where dozens of trawlnets are daily sweeping over the bottom. This shows that the cod succeeds better in escaping the fishing apparatus than the plaice. When the recapture of cod marked on the east and the north coast, where only 1.6—8.4 % were retaken, is compared with that of the cod marked in the Faxa Bay, it appears that the cod fishery in the latter case is much more intensive; but in comparison with the rate of recapture of marked cod in the waters round the Faroes, where Danish marking experiments have been carried out on a large scale in the last years, it is very low. According to DREHSEL [1]) it has appeared, that more than 60 % of the marked cod have been recaptured.

As to the nationality of the fishermen, who have caught the recovered cod in the Faxa Bay, it will be seen from the lists B—D_2 that we only have to deal with two nations, viz. the English and the Icelanders, and the proportion is this: The English have taken 16 specimens or 53.3 % of the 30 fish recaptured, whilst the remaining, or 46.7 %, were taken by the Icelanders. All the fish have, except one (taken by an Icel. open boat) been taken by steamtrawlers. Thus we see that, while the English took by far the greatest part of the plaice marked in the Faxa Bay, in this case the Icelanders have been a match for their competitors, and this again is an expression for the circumstance, that the Icelanders have particular attention to the fishing of cod (their »fish« kat' exochen), whilst they only care little for the plaice.

III. Summary

In the foregoing I have given an account of the marking experiments carried out at different localities on the north and west coast of Iceland in the years 1908—09, and an additional report of the experiments on the north and east coast in 1903—05, which have been previonsly reported by SCHMIDT in his often cited paper. These experiments are in many respects of great interest and the results attained by them of no little value.

These experiments are especially interesting because they are the first experiments in fish marking carried out on the coasts of Iceland, but just as such they presented difficulties of different kinds in fulfilling them. These difficulties were for instance the great conditions in Iceland waters with the somewhat irregulary fisheries, the multitude of the fishing nationalities, which rendered the delivery of the labels from the recaptured fish more difficult, and so on. But in spite of all this, the experiments may, on the whole, be considered to have turned out successfully, thanks to the practical planning and the energetic and skilfull leading of the work.

After these remarks I will finally give a synoptical account of each kind of experiments separately together with some general observations.

The plaice marking experiments

These experiments comprise on the whole 1579 specimens of plaice successively liberated in the Skjalfandi Bay on the north coast, in the Vopna Fjord on the east coast, in the Faxa Bay on the south west coast and off the northwest coast. The following summary will give further information regarding these experiments.

[1]) The international Investigation of the Sea, its Results and practical Objects. 1912.

Marking experiments		Number of plaice		Period of growth (in months)	Average annual of growth (approximately) in cm.	Intensity of fishery %	Retaken
Locality	Year and date	Liberated	Recovered				
Skjalfandi Bay, N-coast	1903, June 27, July 1	280	14	12—14	3.5	5.00	N- and NW-coast
Vopna Fjord, E-coast	1904, July 28, 29	494	33	4—45	2.5	6.67	E-, SE- and S-coast
Faxa Bay, SW-coast	1908, June 16—30	532	124	0—27	6.0	23.31	SW- and NW-coast
Off Bardinn & Patricks Fjord, NW-coast	1908, July 14, 19	73	16	2—29	5.0	21.92	NW- and SW-coast
Faxa Bay, SW-coast	1909, June 30, July 5, 9	200	108	0—4	6.0	54.00	SW-coast (Faxa Bay)

This summary shows the principal results of the experiments of which I will especially draw attention to the circumstance that the plaice marked in the warmer (Atlantic) water on the southwest and northwest coast prove for the greatest part to be stationary, whilst the majority of the plaice marked on the north and east coast are migratory. This agrees well with the fact previously stated by SCHMIDT [1]), that the Icelandic plaice is a warmwater fish, as regards the spawning, which like the cod and several others of the most important food-fishes of Iceland, although spending their younger days (as immature) feeding in the colder waters on the north and east coast, must seek the warmer waters on the south and west coast when maturity (spawning) approaches. Another matter of importance, which the experiments show (although not with desirable exactness), is the circumstance that the plaice marked in the warmer water grow much quicker than those marked in the colder water. Further the experiments give a fairly good idea of the intensity of the fishery of marked plaice on different parts of the coast; this proves to be by far greatest on the west coast, especially in the Faxa Bay, where it rises to 54 %. Here also the stock, or at least the size of the fish is evidently diminishing. (The conditions on the south coast have hitherto not been investigated).

The cod marking experiments

During these experiments 1135 specimens of cod were successively marked and liberated in the Lodmundar Fjord and the Hjerads Bay on the east coast, in the Skaga Fjord, the Eyja Fjord and in the Skjalfandi Bay on the north coast and in the Faxa Bay on the southwest coast. Concerning the main results of these experiments, I will, as above, draw up a summary giving some of the most important of them.

Marking experiments		Number of cod		Period of growth (in months)	Average annual growth (approximately) in cm.	Intensity of fishery %	Retaken
Locality	Year and date	Liberated	Recovered				
Lodmundar Fjord, E-coast . . .	1904, July 25	297	25	0—25	10	8.4	N-, E- and S-coast
Hjerads Bay, E-coast	1904, July 28.	194	4	2—67	10	2.06	N-, E- and S-coast
Skaga Fjord, N-coast.	1905, August 10 18	391	15	0 - 26	8	3.84	N-, NW- and W-coast
Eyja Fjord, N-coast	1905, August 16, 22	26	2	1—2	?	7.7	N-coast
Skjalfandi Bay, N-coast	1908, July 24	27	1	13	?	3.7	N-coast
Faxa Bay, SW-coast	1909, June 27—30, July 1	200	30	0—14	18	15.0	SW and NW-coast

On the whole this summary shows the same features of the principal results of the cod marking experiments as that above concerning the plaice. As the most interesting fact I will point out the circumstance that the cod marked in the Faxa Bay (ɔ: on the southwest coast) have, one excepted,

[1]) Op. cit., p. 22 & Fiskeriundersøgelser ved Island og Færøerne i Sommeren 1903. Skrifter udgivne af Komm. for Havundersøgelser No. 1. 1904, p. 49—50.

proved to be stationary in the bay up to 14 months, whereas some of the cod marked on the north- and east coast have been migratory although the plurality has been stationary[1]). In this respect the cod appears to behave like the plaice: the fry which is carried by the currents (the Irminger current) from the spawning grounds to the northwest, north and east coast, stay there for a long time (3—4 years) but seek the warmer waters again when maturity approaches. The cod which are reared in the warmer water need not undertake any migrations of that kind.

As another not less important matter I will note the fact that the cod reared in the warmer water, like the plaice, grow much more quickly than those which grow up in the colder waters; more over, the growth seems to be so rapid that, as mentioned above, it should not take more than some 4—5 years for the cod to become adult. True, this is only a conjecture of mine, but it is very desirable that it should be investigated soon, as it is a matter of great practical interest and importance to know exactly, how long it takes for the cod to be sexually mature in these waters[2]).

Further the experiments show that the intensity of the capture of young cod seems to be very little, much less than in more southerly and more frequented waters, being only 2—15 % of the marked fish. This and the above mentioned circumstance, that the cod seems to grow so rapidly in the warmer water, where the trawlfishing is most intensive, should be two points more, adopted to save the stock of cod from possible diminishing caused by too intensive fishing (cf. Schmidt, op. cit., p. 21).

Finally the new experiments have again stated that no marked and recovered cod have left Iceland, ɔ: that Iceland has its own stock of cod for itself. It need hardly to be noted that they state the same concerning the plaice.

This will be sufficient to illustrate the important results already attained by the marking experiments in Iceland waters, notwithstanding difficulties of different kinds, and in this connection I desire personally to express the wish, that they may be continued in the nearest future, for I am sure they will throw light on to many points yet unknown or insufficiently known, some of which I have touched on above.

[1]) Some few days ago (ɔ: Nov. 5th 1913) I recieved a label from a cod marked in Lodmundar Fjord 1904 and retaken off the Westman Isles some times in the last winterseason. The label was found on a dried head of the fish, such as the people use them for food.

[2]) About this and the age groups of the cod in these waters I hope we shall get clear knowledge, when the results of the age investigations on cod, plaice and other species, carried out on board the »Thor« during the trip 1908, are published.

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